

SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE
OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, DECEMBER 25, 1903.

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MSs. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

GRANTS MADE BY THE CARNEGIE INSTITUTION.

At the last annual meeting the trustees set apart \$200,000 for grants for research during the fiscal year 1902-3. The following is a list of grants made by the executive committee under such authority. Each one is accompanied by a brief statement of the results thus far obtained. When an investigation is completed, a final report will be submitted by the grantee. This may be printed either in abstract or in full in the 'Year Book.'

ANTHROPOLOGY.

G. A. DORSEY, Field Columbian Museum, Chicago, Ill. *For ethnological investigation among the Pawnees.* \$2,500.

Abstract of Report.—This scheme of investigation will require four or five years for its completion. It is a study of the religious ceremonies of the Pawnee Indians, with direct reference to the mythological origin of each ceremony, and to obtaining a clear and comprehensive understanding of the religious systems of the Pawnees.

The work of collecting and arranging the details of the region of the religion was begun early in the year, and has been pushed forward as rapidly as possible. The work of the first year was to obtain the mythology of the Skidi on the one hand, and the Chaui, Kitkahahki and Pittahauirata bands of Pawnees on the other, and of the Wichita and Arikara. The second re-

sult sought for was to gain a comprehensive insight into all the ceremonies of the four bands of the Pawnees and of the Arikara. Of these two results as much has been achieved as could be hoped for, inasmuch as the work has progressed for only about nine months.

With the beginning of the first of the Skidi ceremonies early next spring, it will be possible to select certain of the more important ones for more detailed observations. Thereafter each ceremony will be studied independently and in detail, and the observations thus made, together with the ritual as sung, will be prepared for publication.

WM. H. HOLMES, Director Bureau of American Ethnology, Washington, D. C.
For obtaining evidence relative to the early history of man in America. \$2,000.

The phenomena to be considered are scattered and obscure. The geological formations of both continents, ranging from Eocene to Recent, abound in various records, but investigation has been in the main desultory and unscientific, and the isolated observations are to-day without adequate correlation.

Mr. Holmes proposed to begin his work with the compilation of all data respecting previous investigations, and then to begin field work which should extend to deposits in caves and caverns where men have lived, and should also include their ancient sites, such as kitchenmiddens, shell heaps, and earthworks.

Abstract of Report.—The field work in this investigation was done mainly by Mr. Gerard Fowke, archeologist, who began work in Indiana and carried his examinations into Illinois, Kentucky, Tennessee and Alabama, exploiting many caves and making careful investigation of a few. Results were distinctly negative with reference to the principal question at issue, the entire season's work having developed no

fact that will tend to establish a theory of the great antiquity of man in America. The season's work, however, was not a failure on this account, since the question is one that must be solved, if not by the discovery of positive evidence, by establishing the universality of negative evidence.

Late in the season explorations were begun on the Atlantic slope by Mr. F. B. McGuire, archeologist, in the caves of the upper Potomac in West Virginia. Mr. Holmes personally made a reconnaissance in Georgia and Alabama for the purpose of collecting definite information regarding the caves of the south.

With the aid of Mr. F. B. McGuire and Dr. J. W. Fewkes, a cave in Porto Rico was explored without expense to the Institution. The present report can be regarded as only one of progress, since Dr. Fewkes and Mr. McGuire are still in the field.

GEORGE F. KUNZ, New York City. *To investigate the precious stones and minerals used in ancient Babylonia in connection with the investigation of Mr. William Hayes Ward.* \$500.

Abstract of Report.—This is an investigation in cooperation with that of Mr. William Hayes Ward. It was deferred until winter in order to secure the cooperation of Mr. Ward after his return from his investigations in Europe.

WILLIAM HAYES WARD, New York City.
For study of oriental art recorded on seals, etc., from western Asia. \$1,500.

Dr. Ward has been for fifteen years devoting his spare time to oriental archeology, with special reference to the beginnings of art and mythology, as shown in recovered monuments and especially in the seal cylinders, which preserve a large part of the early art. He has handled thousands of seals and has paper impressions of thousands. The investigation covers a period

from about 4000 B. C. to about 400 A. D. and will include a study of the mythological representations and various designs, emblems and inscriptions contained in them.

Abstract of Report.—During last summer Dr. Ward has visited various museums in the United States and in Europe, where he examined the great collections of Paris and Berlin. Every facility was granted by the authorities in charge, and he made notes and obtained casts of such cylinders and seals as were required for his investigations. He is now engaged in the preparation of manuscript and illustrations. It is estimated that it will require about two years to complete the study and prepare the results for publication.

ASTRONOMY.

LEWIS BOSS, Dudley Observatory, Albany, N. Y. *For astronomical observations and computations.* \$5,000.

Abstract of Report.—This work has for its ultimate object an investigation upon the motions of the brighter stars (all down to the seventh magnitude), and of all stars, of whatever magnitude, supposed to have motions as great as 10" per century, and of many other stars which were specially well determined prior to 1850.

During the year Professor Boss's attention was given to—

(a) The compilation for each star of all observations for position that have been made upon it during the history of astronomy. Some stars are found in more than sixty catalogues.

(b) Investigation of the systematic errors with which each series of meridian observations seems to be affected, in order that the precision of the results may be notably increased. This involves in the first place the establishment of a standard of reference, which must include the positions of all those stars which have been

most frequently and accurately observed.

The entire work is proceeding upon a logical plan carefully studied and formulated through the results of experience during past years, with a view to economy in the succession of individual investigations designed to contribute to the final result. In an extensive investigation of this kind there is always an element of danger. If the work is so planned that definite results can not be realized until the completion of the whole work, there is liability to serious loss from the ordinary accidents of life which can not be foreseen. Therefore this work has been so planned that useful results can be secured and promptly published at every successive stage of the work. Each step grows logically out of those which have preceded it. The computations are so planned that successive improvements in the fundamental basis can be introduced with the least possible duplication of work.

It is intended that the catalogue of more than 2,500 standard stars shall be offered for publication to the Carnegie Institution early in 1905, and if no unforeseen accidents occur this program should be entirely feasible.

During the present year the catalogue of 627 standard stars has been passing through the press and is now nearly ready for issue. Subsidiary investigations connected with this catalogue have been carried out under the grant of the institution for this year.

BOSS, HALE AND CAMPBELL. *For investigating proposal for a southern and a solar observatory.* \$5,000.

In the Year Book for 1902 a proposition for the establishment of a distinctly solar observatory was presented by Professor S. P. Langley. In the same report (page 89) the astronomical advisers called attention to the lack of observatories in the southern hemisphere, and in an appendix (pages 99

to 104) they treated the subject still more fully.

In order that the board of trustees might be enabled to arrive at appropriate conclusions, Professor Lewis Boss, chairman; Professor George E. Hale and Professor W. W. Campbell were requested to investigate, as a committee, the subject more fully and to consider the question of suitable sites for such observatories.

The result of the work of this committee is submitted in the 'Year Book.'

W. W. CAMPBELL, Lick Observatory, Mt. Hamilton, Cal. *For pay of assistants to take part in researches at the Lick Observatory.* \$4,000.

Abstract of Report.—Owing to the difficulty of obtaining satisfactory assistants from the east and providing living quarters for them on the mountain, it was not found possible to provide for an effective use of the grant for the employment of assistants and computers until late in the year. Investigations were begun with the meridian circle work and in spectroscopy. With the construction of additional residence quarters on the mountain, Professor Campbell will soon employ the full number of assistants rendered possible by the grant.

HERMAN S. DAVIS, Gaithersburg, Md. *For a new reduction of Piazzi's star observations.* \$500.

American and European astronomers have urged that a fresh reduction of these observations by known methods for obviating certain errors should be made. Professor Porro, of Turin, undertook a part of the reductions and Professor Davis the rest. Assistance from private persons and from observatories has contributed to the prosecution of this undertaking. The Carnegie Institution was asked to make a small contribution.

Abstract of Report.—The work accomplished under this grant has been in con-

nection with work that was already begun. This makes it difficult to define specifically the exact amount done under the grant from the Carnegie Institution. The period of nine months, during which the grant has been available, has marked the transition from the routine work of reducing the observed 'apparent' positions of the stars to a common 'mean' epoch to the next large step of deducing therefrom the instrumental errors and compiling the final catalogue. This rendered it necessary to spend this time in rounding out and perfecting all the divers portions of the computations which have been going on uninterruptedly for the past seven years. This has been finished, and also some preliminary work done for the next great and distinct stage of the work: (a) To deduce the errors of the telescope for each night of observation; (b) to correct all observations for these maladjustments, and (c) finally, to combine the definite separate positions into means for each star included in the catalogue, which is the goal of the long labor.

GEORGE E. HALE, Yerkes Observatory, Williams Bay, Wis. *For measurements of stellar parallaxes, solar photographs, etc.* \$4,000.

Abstract of Report.—Work was begun on the photographic investigation of stellar parallaxes early in May with a forty-inch telescope. Up to October, 114 plates, containing about 350 exposures, had been obtained. These included: (a) Twenty experimental plates, (b) eighty-eight plates suitable for parallax determinations, and (c) six plates of loose star clusters.

Considerable work was also done in the measurement of photographs of star clusters.

Another line of investigation was the photometric determination of stellar magnitudes. Considerable progress was made in this, fields being measured with the six-

inch reflectors and the twelve- and forty-inch refractors. Measures were also made upon the Pleiades group of stars to determine the constant of the equalizing wedge photometer. Measurements were also made of comparison stars for faint variables.

Much progress was also made in the measurement and discussion of photographs of the sun, taken with the spectroheliograph at the Kenwood Observatory in the years 1892-6, and in other minor investigations connected with the work in hand.

SIMON NEWCOMB, Washington, D. C. *For determining the elements of the moon's motion and testing the law of gravity.* \$3,000.

Much of the material for this investigation, consisting of computations of places of the moon from Hansen's tables and their comparison with observations, was preserved in the archives of the Nautical Almanac Office, awaiting an opportunity for their working up. By permission of the Secretary of the Navy, Hon. William H. Moody, these papers were entrusted to the Carnegie Institution and by the Institution to Professor Newcomb.

Abstract of Report.—The importance of this work grows out of the fact that new tables of the moon are urgently required for the purposes of astronomy and of navigation. For a long period the problem of constructing and perfecting such tables has been delayed by an unexplained discordance between the observed motion of the moon and the motion which should result from the action of all known bodies upon it. The exact cause of this discordance can not be recorded, because the observations from 1750 to 1850 have never been worked up and compared with the tables. The problem of determining the exact nature of the deviation of the moon from its predicted place is twofold. The observations since 1750 must be worked up, and

in order to compute the comparison the action of the planets on the moon must be recomputed with a view to determining whether any correction to the past computations is necessary.

By aid of a grant from the Carnegie Institution an important term of long period, produced by the action of Venus, has been recomputed.

Professor Newcomb has taken up the work on the adopted plan of the occultations of stars by the moon, a work that he had begun in connection with the Nautical Almanac. This, in connection with the incorporation of other important observations, can probably be completed in two years more.

E. C. PICKERING, Harvard University, Cambridge, Mass. *For study of the astronomical photographs in the collection of Harvard University.* \$2,500.

Abstract of Report.—The grant made to Professor Pickering was applied to a great variety of uses. These included sums paid to nineteen different assistants and computers, and for other assistance in connection with the Harvard Observatory.

Each of the numerous investigations is of importance in carrying forward the work going on in the observatory, but they do not appear to be upon sufficiently definite and specific problems, as given in his report, to permit of a distinct statement, in most cases, of the progress of the work under the Carnegie Institution grant.

Professor Pickering reports that in forming a corps of observers to study the photographs, time and money being limited, it was difficult to decide what subjects to select from this vast amount of material. A number of problems have accordingly been studied which serve to illustrate the various investigations which might be undertaken. Abridged results of a portion of these were promptly published in the Harvard Observatory Circulars nos. 69 and

70. The principal researches carried on are as follows: (1) Eclipses of Jupiter's satellites; (2) light curves of Algol variables; (3) position and brightness of stars in clusters; (4) observations have been made of the changes in light of nine variable stars of long period, during several years before they were discovered; (5) early observations of stars of the Algol type and other variables of short period; (6) transit photometer; (7) Nova Geminorum; (8) variations in brightness of Eros; (9) proper motion of stars; (10) missing asteroids, and (11) many images of interesting objects like new stars, variables and asteroids doubtless appear on the photographs. An examination has accordingly been made of several of the plates to determine whether it would be advisable to examine a large number of them systematically for the discovery of such objects.

WM. M. REED, Princeton Observatory, Princeton, N. J. *For pay of two assistants to observe variable stars.* \$1,000.

Abstract of Report.—Owing to the difficulty of obtaining an observer, work was not begun till March 1. During the seven months from March 1 to October 1, the 23-inch telescope of the Halsted Observatory, exclusively for photometric work, was used on every clear night from early in the evening until daylight. In all 9,015 observations were made on about fifty different stars.

Three classes of stars were observed:

(a) Such variable stars as are too faint to be reached by any except the largest telescopes. In particular, selection was made of stars that have become too faint for the Harvard observers and those co-operating with them.

(b) Measurement of faint stars that are to be used as standards of magnitude. In this work they are connecting stars of the thirteenth magnitude with those of the

fifteenth magnitude. The Lick and Yerkes observatories are connecting the fifteenth magnitude stars with the sixteenth magnitude, and the Harvard Observatory is connecting the eleventh magnitude with the thirteenth magnitude.

(c) A special study of the newly discovered Algol variable, 4.1903 *Draconis*, has been made, and a preliminary article giving the results of these observations has been sent to the *Astronomical Journal*.

MARY W. WHITNEY, Vassar College, Poughkeepsie, N. Y. *For measurement of astronomical photographs, etc.* \$1,000.

Abstract of Report.—This work consists in the measurement and reduction of stellar photographs taken at the observatory at Helsingfors, Finland, by Professor Donnor. The measurement of the eight plates is finished and the reduction is well along. A preliminary catalogue of the mean places of 404 stars within two degrees of the pole is nearly completed. The work was pressed during the last quarter, as Professor Whitney then secured the services of an expert computer. The intercomparison of the plates and the determination of proper motion remain to be studied.

BIBLIOGRAPHY.

ROBERT FLETCHER, Army Medical Museum, Washington, D. C. *For preparing and publishing the 'Index Medicus.'* \$10,000.

The 'Index Medicus' was established in 1879, under the direction of Dr. John S. Billings and Dr. Robert Fletcher, and discontinued in 1899, after twenty-one volumes had appeared, for the lack of pecuniary support.

Abstract of Report.—The scope of this work is very broad with relation to the medical sciences. It contains, in classified form, month by month, reference to everything published throughout the world which relates to medicine or public hygiene. The latter comprises all that concerns the

public health in its municipal, national and international relations.

Nine numbers of the volume have been issued, and the volume will be complete with the January number, when the 'annual index' will be compiled. The index is a very elaborate piece of work, and will comprise 200 pages in double or triple columns. The work is of great value to all the medical profession, especially to professors in medical schools and colleges, officers of health and workers in scientific laboratories.

The subscribers to the 'Index Medicus' are chiefly residents of the United States, but the list includes subscribers in England, Ireland, Scotland, Canada, Australia, France, Germany, Spain, Portugal, Roumania, Sweden, Switzerland and Manila. There are now 455 subscribers.

HERBERT PUTNAM, Librarian of Congress, Washington, D. C. *For preparing and publishing a 'Handbook of Learned Societies.'* \$5,000.

In order that the scientific investigators of this country, and especially those connected with the Carnegie Institution, might have an accurate knowledge of the agencies which now exist for the promotion of scientific inquiry in every part of the world, the advisory committee on bibliography recommended that a descriptive catalogue be prepared of all the learned societies of the world.

At the present time such information, and particularly regarding the publications of learned societies, is incomplete and unorganized, being scattered through a large and miscellaneous collection of volumes, many of which are inaccessible and not well known. A careful and comprehensive list would be of great value to all the librarians of the country who aim at the preservation of the transactions of learned bodies. It would also furnish a basis for exchanges. The funds for research work held by these

various institutions have special significance with reference to the activities of the Carnegie Institution. The plan of the handbook included information as to these eleven points: (1) Name or names of the society or institution, indicating any change which may have occurred, with cross references; (2) objects of the society; (3) brief historical note; (4) endowments, research funds, prizes, etc; (5) officers of the society; (6) membership, numbers, conditions and manner of election, dues, etc.; (7) meetings—their character, frequency, time and place; (8) communications—regulations for presentation and publication of papers; (9) list of officers, with address of corresponding secretary; (10) complete and detailed bibliography of all regular or special publications since the foundation of the society, editions (how large?) to satisfy all the above mentioned requirements; (11) publications—conditions and methods of distribution; prices.

According to the plan of work approved, the handbook is to be in volumes; societies to be classified by subjects, with local arrangement, and each class to constitute a separate part. The following order of procedure has been adopted: (a) To prepare a list of societies from the exchange lists at the Smithsonian Institution and elsewhere in Washington, and a card catalogue to keep orderly record of communications; (b) to issue a suitable circular to these societies, requesting the desired information; (c) to prepare for publication the material received, filling out lacunæ by further correspondence and reference to various sources of information; (d) in the case of societies not replying to circular or letter, and in regard to which sufficient information can not be obtained from printed sources, to adopt such other methods as the progress of the work may suggest.

The first stage of this work was the preparing of a card catalogue of names of

learned societies and institutions. Every source of information known and available in the Congressional Library was searched to make this as nearly complete as possible, at the same time separating (1) dead societies and (2) societies not publishing any material of importance to investigators.

The second stage of the work was the sending of a circular letter, containing an outline of the information required, to academies and societies dealing with historical and social science in Europe and North America. Russia and other Slavic countries, and also Austria and Hungary, are being treated independently, advantage being taken of a visit to Russia by Mr. A. V. Babine, of the Library of Congress. Mr. Thompson and Mrs. Thompson made personal visits to England, Paris, Belgium, Holland and Berlin for the purpose of supplementing the information obtained by correspondence. It is anticipated that Mr. Thompson will also visit Italy and Switzerland.

The third stage of the work, the reduction of the replies received to standard form, was begun in August, and is now going on in the office at Washington. It is expected that this work will be brought to completion in 1904.

BOTANY.

W. A. CANNON, New York Botanical Garden, N. Y. *For investigation of plant hybrids.* \$500.

Abstract of Report.—Under this grant Mr. Cannon worked at the New York Botanical Garden until September 1, 1903. He prepared a paper on the spermatogenesis of the hybrid peas and collected material for the study of the sporogenesis of two fern hybrids.

H. S. CONARD, University of Pennsylvania, Philadelphia. *For study of types of water-lilies in European herbaria.* \$300.
Abstract of Report.—The grant made to

Mr. Conard was to enable him to examine the types of water-lilies in various European herbaria for the purpose of completing a memoir on water-lilies which the Carnegie Institution is about to publish. He was successful in obtaining the requisite data, and the memoir will soon go to press.

DESERT BOTANICAL LABORATORY (F. V. Coville and D. T. MacDougal, Washington, D. C.). \$8,000.

At the meeting of the trustees in November, 1902, a comprehensive plan for the encouragement of botanical researches was submitted by the advisory committee on botany (see 'Year Book,' No. 1, pages 3-12).

In carrying out this plan, Mr. F. V. Coville, botanist of the Department of Agriculture, Washington, and Mr. D. T. MacDougal, director of the laboratories of the New York Botanical Garden, were requested to go to the arid lands of the west and make such further recommendations as might seem to them best. They became persuaded that the best position for the laboratory, considering both natural and artificial advantages, is Tucson, Arizona, and they recommended its establishment there and the engagement of Dr. W. A. Cannon to be resident investigator.

A full report with respect to the organization of this laboratory and of the various circumstances which led up to it will be published in a monograph soon to be printed among the publications of the Carnegie Institution.

Abstract of Report.—Messrs. Coville and MacDougal were appointed a committee on the subject of a desert botanical laboratory.

After their visit to the principal points in the southwestern desert region, a laboratory location was selected near Tucson, Arizona.

The building site, water supply, road and electrical connection were presented by the Chamber of Commerce of Tucson, the cash

value of these concessions amounting to about \$1,400, and the discussions that took place initiating what is still more valuable—the hearty interest and cooperation of the citizens in the purposes of the laboratory.

A laboratory building has been planned, contracted for and completed, the contract price being \$3,843. The laboratory has been equipped with books, apparatus, furniture and supplies, at a cost of \$1,813.50.

Dr. W. A. Cannon, recently connected with the New York Botanical Garden (Bronx Park), New York, was appointed resident investigator, and took charge of the laboratory September 1. He is now engaged in investigating the root systems of desert plants with reference to their special devices for the absorption and storage of water.

The privileges of the laboratory have been granted to Professor Charles B. Davenport, University of Chicago, for an inquiry into the morphological and physiological adjustment of desert animals to their habitat. Other applications are pending.

The committee has presented an illustrated report on the laboratory location, which is now in press as a publication of the institution.

E. W. OLIVE, Crawfordsville, Ind. *Researches on the cytological relations of the Amœbæ, Acrasieæ and Myxomycetes.* \$1,000.

Abstract of Report.—Mr. Olive's work has been carried on in Professor Strasburger's laboratory in the Botanical Institute at Bonn, Germany. In order to do this work he resigned his position as instructor at Harvard University. His studies include cultures of the Acrasieæ and of the Labyrinthuleæ, which he had brought from America.

Mr. Olive's report shows definite progress in his research, and the prospect of the completion within two months of two papers incorporating a portion of his results.

JANET PERKINS, working at the Royal Botanical Gardens, Berlin, Germany. *For preliminary studies on the Philippine flora.* \$1,900.

Abstract of Report.—Dr. Janet Perkins reports that she was engaged in the proposed investigation from February 20 to October 5, 1903. A catalogue of the Philippine flora was begun, based on various monographs and papers which have appeared in scientific periodicals. This work consumed much time, as literature regarding the Philippines is greatly scattered, and the synonymy needs a thorough clearing up.

Among other matters that were begun were: (a) A catalogue of the various native names, (b) a list of botanical literature pertaining to the Philippines, (c) the attempt to construct a type herbarium of Philippine plants, (d) the determination of certain Philippine plants received from the Department of Agriculture, and (e) the preparation of a sample copy of the manuscript and illustrations for the position of the family Marantaceæ.

CHEMISTRY.

W. D. BANCROFT, Cornell University, Ithaca, N. Y. *For a systematic chemical study of alloys, beginning with the bronzes and brasses.* \$500.

Abstract of Report.—The experimental work under this grant has been done by Mr. E. S. Shepherd, under the direction of Professor Bancroft. They have analyzed the different solid bases and determined the copper-tin-lead diagram except for the alloys containing less than twenty per cent. of copper. They have determined the densities and electromotive forces of the

annealed bronze, and made a careful microscopic study of the same alloys. Work is now under way on the density and determination of bronzes cast in vacuo, the copper-tin-lead diagram, and the making of the necessary analyses. A study of the physical properties of bronzes will be carried on during the winter.

L. M. DENNIS, Cornell University, Ithaca, N. Y. *For investigation of the rare earths.* \$1,000.

Professor Dennis has been engaged for the past ten years in the study of the rare earths, and has accumulated a large amount of purified material. He proposed to carry on a study with special reference to improvements in the methods for determining the atomic masses of these substances, and for separating the elements of the yttrium group.

Abstract of Report.—The work under this grant was carried on by Dr. Benton Dales in the laboratory of Professor Dennis, of Cornell University. Dr. Dales has submitted a report on the ammonium carbonate and acetic acid method of fractionation. The source of the rare earths used in the work was xenotime, essentially a phosphate of the yttrium group of earths from Brazil. The work is unfinished, owing to Dr. Dales having resigned his position at Cornell University before completing it. Three fourths of the grant was used. A paper containing the results of the investigation, as far as obtained, was transmitted for publication.

H. C. JONES, Johns Hopkins University, Baltimore, Md. *For investigations in physical chemistry.* \$1,000.

Abstract of Report.—Under the direction of Professor Jones, Dr. F. H. Gatman began work October 1, 1903, by investigating certain apparently abnormal phenomena manifested by concentrated solutions of electrolytes in water and other

solvents. They expect to be able to report considerable progress by the end of the year.

H. N. MORSE, Johns Hopkins University, Baltimore, Md. *For researches on osmotic pressure.* \$1,500.

Abstract of Report.—Professor Morse reports that the immediate problem to be solved was the development of a practical method for measuring osmotic pressure. Although osmotic pressure has been recognized for twenty-five years as one of the great forces of nature, there have been no direct measurements to furnish an adequate experimental basis for the laws supposed to govern it. Professor Morse has been engaged for several years in attempting to overcome the difficulties which lie in the way of quantitative measurements of osmotic pressure. He states the problem under three heads, as follows: (1) The preparation of a suitable semipermeable membrane, (2) the overcoming of the mechanical difficulties in assembling the different parts essential to the complete osmotic cell, and (3) the production of an efficient porous wall on which to deposit the semipermeable membrane.

Professor Morse has succeeded in solving the problems designated by (1) and (2), and the work since October, 1902, has been prosecuted by him and Mr. J. C. W. Fraser, working in the laboratory of the Johns Hopkins University. They have found it necessary not only to work out theoretically, but also practically, the problem of the production of a suitable porous wall, necessitating the molding of the clay under great pressure in order to give the cell wall a higher and more uniform degree of compactness than is secured by the usual methods of the potter, and to remove thoroughly the air blisters and cavities which render most porous walls unfit for experimental work in osmotic pressure. Their

attention was, therefore, turned, in the second place, to the devising of apparatus for the forming of the clay vessels under pressure, with the result that they now possess two pieces of apparatus which work to entire satisfaction. They next proceeded to take up the problem of baking the clay vessels, and devised an electric kiln which was effective and well adapted to general use in the laboratory. They are now ready to begin the making, baking and burning of porous cells.

A. A. NOYES, Massachusetts Institute of Technology, Boston, Mass. *For certain chemical investigations.* \$2,000.

Abstract of Report.—The work under the direction of Professor Noyes, on the electric conductivity of salts and aqueous solutions at high temperatures, has been in progress for several months, with the assistance of Dr. William D. Coolidge. Much of the time has been given to the construction of an effective platinum-lined conductivity cell or bomb, suitable for exact conductivity measurements with aqueous solutions up to 306° or higher, and in other preparatory work.

Now that the serious difficulties in the production of the conductivity apparatus, suitable for measurements at high temperatures and pressures, have been overcome, and the possibility of obtaining accurate results has been demonstrated by a series of determinations extending with a few salts up to 306°, it is highly desirable to extend the measurements to salts of other types and to acids and bases, and to the critical temperature of 360°. This work is very difficult and it will be necessary to continue it for a number of years before it will be completed.

Two other researches for which the aid granted was employed were begun in September, with the assistance of Dr. Herman C. Cooper and Mr. Yogoro Kato.

THEO. W. RICHARDS, Harvard University. *For investigation of values of atomic weights, etc.* \$2,500.

Abstract of Report.—Professor Richards has submitted a memoir about to be published by the Carnegie Institution, containing the records of his experiments on a new method of determining compressibility. By means of this method the compressibilities of bromine, iodine, chloroform, bromoform, carbon tetrachloride, phosphorus, water and glass have been determined over a range of 700 atmospheres.

Besides the continuation of the preceding work, several other investigations are in progress, assisted by this grant. One of these concerns the effect of pressure on the electrochemical solution tension of metals; another concerns the heat capacity of solutions, and another concerns the atomic weight of sodium.

J. BISHOP TINGLE, Illinois College, Jacksonville, Ill. *For continuing investigations on the derivatives of camphor and allied bodies.* \$500.

Abstract of Report.—The work under this grant was not begun till late in the summer. A number of bases have been tested as to their power to undergo condensation with camphoroxalic acid and its ethylic salt. Experiments have also been made to obtain further information as to the possible presence of hydroxyl groups in camphoroxalic acid, with encouraging results.

ENGINEERING.

W. F. DURAND, Cornell University, Ithaca, N. Y. *For experiments on ship resistance and propulsion.* \$4,120.

Abstract of Report.—Professor Durand reports that certain equipment necessary for the conduct of the experiments was completed early in the spring. Experiments in connection with the work on propellers were begun, and all of the work of

observation required for the complete determination of the performance of thirty-five model propellers was finished. To complete the investigation immediately in view, fourteen propellers remain to be experimented with. He feels that the complete experimental determination for thirty-five propellers constitutes a most satisfactory summer's work. This is five sevenths of the entire field to be covered by this particular investigation. The work of making the detailed reductions and analyses of these observations will presumably occupy most of the winter. But very gratifying progress has been made in the preliminary measurements, speed having been determined from distance and time records in 444 cases and thrust-turning momentum determined by integration from autographic records in 655 cases.

LEONARD WALDO, New York City. *For study of aluminum bronzes.* \$4,500.

Abstract of Report.—Mr. Waldo reports that through the death of his associate, George S. Morison, and the break down in health of his chief assistant progress has been slow; he is unable to do more than report progress. He (a) prepared a bibliography on alloys of aluminum and copper and of other aluminum compounds; (b) has had in operation six kinds of specially built furnaces, and is building a seventh, to determine the best methods for making large castings and sound wire bars or billets of aluminum bronze; (c) his rolling mill experiments for producing tubes, sheet, wire and forged bars, from billets cast during the year, are practically complete and are satisfactory.

Notes taken during the process of rolling and cold drawing, relative to temperature, speeds and cost are awaiting collation and reduction. A complete report will be prepared during the coming year.

EXPLORATION.

RAPHAEL PUMPELLY, Newport, R. I. *For preliminary examination of the trans-Caspian region.* \$6,500.

Abstract of Report.—The reconnaissance covered a region of 1,750 miles in length, with trips from 10 to 300 miles away from the railroad base. Throughout the great part of this area the remains of ancient occupation abound, in the form of large tumuli, village sites, fortresses and cities.

The structure of the tumuli examined and their contents indicate a very remote beginning and occupation during long periods. The builders had apparently archaic pottery, no metals, slight knowledge of stone implements and probably wooden weapons. The people were settled and had the domestic horse, cow, pig, sheep and goat. Many of these seats of early dwelling seem to have become in time eminences upon which arose fortresses, or to have become the citadels of towns growing up around them. Thus they probably contain the continuous record of the development of the civilizations of the region from a very remote antiquity down to historic times.

The reconnaissance work of Professor Davis, Mr. Huntington and R. W. Pumpelly has shown the former existence of several glacial epochs, and has made much progress in correlating these with the progress of prehistoric physical events in the building of the plains and the expansions of the former Aralo-Caspian seas. Their observations give reason to hope that further study will correlate these physical events with important phases of human development in connection with Asiatic and European history.

GEOPHYSICS.

FRANK D. ADAMS, McGill University, Montreal, Can. *For investigating the flow of rocks.* \$2,500.

Professor Adams has been engaged for some years past in an experimental investigation into the nature of the movements set up during the folding and deformation of the rocks of the earth's crust.

Abstract of Report.—Dr. Adams reports that McGill University has provided for his use in carrying on the investigation on the flow of rocks a large room in the basement of the new chemical building of the university. In this room he has installed the apparatus he formerly had and ordered a third and much more powerful hydraulic press, by which pressure up to 120 tons may be secured and maintained, if necessary, for weeks at a time. Ample provision has been made in the installation of the new hydraulic press, looking to the possibility of the extension of the plant in its adaptation to the most varied experimental uses.

On the completion of the installation Dr. Adams commenced the investigation of high differential pressures on dolomites from Maryland, Massachusetts and the province of Quebec. It was found that at ordinary temperatures these dolomites could be made to flow in the same manner as in the case of the pure Carrara marble. He is now carrying on experiments to ascertain the effect of heat upon the flow of dolomite. In order to compare the effects produced at high pressures with those produced by lower pressures, the higher representing the condition at lower depths in the earth's crust, experiments have been begun on the flow of marble with the 120-ton press.

Dr. Adams is also carrying on a series of investigations into the force required to drive water Portland oolite, which is the rock he has selected for further experiments on the deformation of limestones when heated, with water passing through them. He has also assembled material to commence the study of granite essexite and

diabase, as typical igneous rocks under very high pressures at ordinary temperatures.

C. R. VAN HISE, University of Wisconsin, Madison, Wis. *For investigating the subject of geophysical research, etc.* \$2,500.

In the 'Year Book' for 1902, page 26, an extended report was presented on the subject of geophysics. As the trustees were not prepared to act upon the project, a further study of the problem was made, at the request of the executive committee, by Professor Van Hise, who investigated the subject of geophysical research in European institutions and made a report, which is printed in the 'Year Book.'

GEOLOGY.

T. C. CHAMBERLIN, University of Chicago, Chicago, Ill. *For study of the fundamental principles of geology.* \$6,000.

Abstract of Report.—Plans for the consideration of the different phases of the complex subjects of this investigation were arranged with numerous collaborators, and details of this collaboration and the results obtained are given in Professor Chamberlin's report printed in the 'Year Book.'

BAILEY WILLIS, U. S. Geological Survey, Washington, D. C. *For geological exploration in eastern China.* \$12,000.

This grant was for the purpose of carrying on a comparative study of the geology of eastern Asia and western North America, by observations in stratigraphy, structure and physiography in eastern China and Siberia, and by the collection of fossils, particularly with reference to the development of the Cambrian faunas.

He proposed to begin his inquiries in the mountain district in Shantung—the Tai-shan—a geological unit of about 4,000 square miles, where a study could be made of the geology from pre-Cambrian gneisses to the Coal Measures.

Mr. Eliot Blackwelder, an instructor in elementary geology and paleontology in the University of Chicago, accompanied Mr. Willis.

Abstract of Report.—Under date of September 30, 1903, from Tientsin, China, Mr. Willis reports that all preparations are completed, that authority has been received from the Chinese and German governments, and that with his associate, Mr. Blackwelder, he is about to leave for the province of Shantung. From Shantung it is proposed to go to Liautung. Mr. Willis expects to return to Pekin January 1, 1904, and as soon as may be thereafter to enter upon a trip that will probably continue until the end of June, 1904.

HISTORY.

WORTHINGTON C. FORD, Library of Congress, Washington, D. C. *For an examination of the historical archives of Washington.* \$2,000.

For the purpose of studying the historical archives of Washington and ascertaining their extent and their characteristics, Mr. Ford prepared a scheme of inquiry which was arranged in two divisions. The first division included a general statement of the contents of each repository of archives, a statement of the place in which it is contained, and the history of the collection; also a statement of the funds available for the maintenance of the collection and of the conditions under which documents are accessible. The second division referred to the preservation of the collections and the arrangements for enlarging them.

Abstract of Report.—The purpose of this grant was to defray the expense of making a general survey of the archives of the government and the preparation of a report which would be helpful to historical investigators. Dr. Claude H. Van Tyne and Mr. Waldo G. Leland began the work

in January, 1903, following general suggestions offered by Mr. Ford. They have examined the manuscript material in every branch of the government, and have prepared a statement as to the nature and extent of the administration records, as well as of the more important collections of historical material. This description is now nearly ready for printing. It will make a book of 250 or 300 pages of the size of the 'Year Book.' While it does not attempt to describe individual documents, but only classes and collections of documents, it is sure to be helpful to historical scholars seeking material.

PALEONTOLOGY.

E. C. CASE, State Normal School, Milwaukee, Wis. *For continuation of work on the morphology of Permian reptiles.* \$500.

Abstract of Report.—In connection with the preparation of a monograph on the Pelycosauria of the American Permian deposits, Professor Case spent most of the summer in the British Museum and several weeks in the museums of Paris and Berlin in the study of the reptiles of Permian age contained therein. The main line of work resolved itself into a careful comparison of the faunas of the deposits of America, Russia and South Africa. The most important result was the demonstration that American forms are practically completely different from those of Russia and South Africa, the sole connecting faunas being of the most primitive type, and none, so far as known, being common. This emphasizes the peculiarity of the presence of a typical American Pelycosaurian in the deposits of Bohemia. Professor Case also obtained many isolated facts of morphology that will be of material assistance to him in the study of the fauna.

O. P. HAY, American Museum of Natural History. *For monographing the fossil Chelonia of North America.* \$2,200.

Abstract of Report.—Dr. Hay reports that he has prepared 200 pages of type-written manuscript, and has had made, under his personal supervision, 210 drawings and 80 photographs of fossil turtles. He finds that there are about 180 species, and that there yet remains much to be done before the monograph will be ready for publication. During the summer he spent two months in the Bridger deposits of Wyoming, collecting fossils, and secured 135 specimens of turtles that will add greatly to our knowledge of Eocene forms.

G. R. WIELAND, Yale University, New Haven, Conn. *For continuation of his researches on living and fossil cycads.* \$1,500.

Abstract of Report.—Dr. Wieland expects to have a memoir ready by the close of the calendar year, dealing with the fossil cycads from a biological standpoint. He has developed a new method for the study of fossil cycads by perfecting or inventing inverted drills, by means of which he has secured leaves, branches, fruits, flowers and terminal buds in the form of cylindrical cores cut from the cycad trunks. He has also adopted the novel plan of cementing together again, in their original position, the parts of such cores resulting from the cutting of a series of thin sections, and in this way securing a second series, also complete. By these methods he has cut a dozen fruits, in various stages of growth, from a silicified cycad trunk. He has also cut thin longitudinal and transverse sections of flowers surrounded by leaf bases. It is now possible to make, in the case of cycads, intensive studies of single trunks, such as have never before been made in the case of any fossil plants.

S. W. WILLISTON, University of Chicago, Chicago, Ill. *For preparing a monograph on the Plesiosaurian group.* \$800.

Abstract of Report.—Professor Williston reports that he investigated the type material of Plesiosaurs at Colorado College, University of Kansas Museum, the American Museum of Natural History in New York, the Museum of the Academy of Natural Sciences, Philadelphia, and the National Museum, Washington. Important material has been sent him from these and other sources, upon which he is at present engaged. He hopes to complete his study during the year 1904.

PHYSICS.

HENRY CREW, Evanston, Ill. *For study of certain arc spectra.* \$1,000.

Abstract of Report.—Professor Crew reports that after the building of certain apparatus, which required several months, he began the experimental part of his work. He found unexpected difficulties in working with magnesium and zinc, the two metals in which he hoped to find the order of appearance of the lines of the spark spectra.

His second problem was to complete the maps of the spectra of cadmium and aluminum. The map of the cadmium arc has been completed; that of aluminum nearly so.

The difficulty of obtaining an oscillograph has delayed the beginning of work on the third problem, the determination of the E.M.F. curves with the 'rotating metallic arc.'

A. A. MICHELSON, University of Chicago, Ill. *For aid in ruling diffraction gratings.* \$1,500.

Abstract of Report.—Professor Michelson encountered many serious difficulties in the ruling engines for diffraction gratings, most of which he now believes are overcome. The work is now being pushed

vigorously, and he hopes before another year to make a favorable report on the results obtained.

HAROLD PENDER, Johns Hopkins University, Baltimore, Md. *For experiments on the magnetic effect of electrical convection.* \$750.

Abstract of Report.—The object of Dr. Pender's grant was to perform in Paris, in conjunction with Mons. B. Cremieu, experiments on the magnetic effect of electrical convection and to confer with M. Poincaré concerning the same. Dr. Pender met with great success in clearing up a controverted question as to the presence of a magnetic field about a bare metallic surface when charged and set in motion, which field is in all probability due to what is usually termed a convection current of electricity.

R. W. WOOD, Johns Hopkins University, Baltimore, Md. *For research, chiefly on the theory of light.* \$1,000.

Abstract of Report.—Professor Wood reports that one half of the grant has been expended for the salary of an assistant, and that the balance he plans to expend for apparatus. Through the aid given he was able to accomplish much more experimental work than he otherwise could have done. During the year he obtained results which were published in seven papers, all of which pertain to researches connected with the theory of light.

A considerable amount of work was also done on an investigation on the dispersion of sodium vapor; this has not yet been published.

PHYSIOLOGY.

W. O. ATWATER, Wesleyan University, Middletown, Conn. *For experiments in nutrition.* \$5,000.

Abstract of Report.—The purpose of this grant was to promote researches involving the direct determination of the amount of

oxygen consumed by man for sustaining the bodily functions. The grant has been expended chiefly for the services of experts and assistants, for devising and constructing or purchasing apparatus, for developing methods for the determination of oxygen and for efficiency tests and experiments with men in the apparatus.

Several tests of the efficiency of the apparatus and method of manipulation were made. The feasibility of the use of the apparatus for the experiments with men has also been tested by three experiments with different subjects, with satisfactory results. Attention is now being devoted to alterations and improvements in the apparatus and to modifications of methods; efficiency tests and experiments with men are also in progress.

ARTHUR GAMGEE, Montreux, Switzerland.

For preparing report on the physiology of nutrition. \$6,500.

Abstract of Report.—Dr. Gamgee began and has carried on a study of the extensive literature on this subject, which had to be mastered for the purpose of the inquiry on which he was engaged. He began by inspecting European laboratories and by visiting scientific men in Europe. He also visited Professor Atwater, at Middletown, Conn., and acquainted himself with the work now in progress there. He also visited other Americans. It is probable that his complete report will be transmitted in May, 1904.

PSYCHOLOGY.

G. STANLEY HALL, Clark University, Worcester, Mass. *For certain investigations on the anthropology of childhood.* \$2,000.

Abstract of Report.—The result of Dr. Hall's work in connection with this grant is best indicated by the titles of the papers he has published, giving the results obtained during the year. These are (1) Reaction to light and darkness; (2) children's ideas of fire, heat, frost and cold; (3)

curiosity and interest; (4) showing off and bashfulness as phases of self-consciousness, and (5) marriage and fecundity of college men and women.

E. W. SCRIPTURE, Yale University, New Haven, Conn. *For researches in experimental phonetics.* \$1,600.

Report.—Professor Scripture's report is printed in the 'Year Book.'

ZOOLOGY.

H. E. CRAMPTON, Columbia University, New York. *For determining the laws of variation and inheritance of certain lepidoptera.* \$250.

Abstract of Report.—In order to obtain data for the problems of variation, their relation to selection and for the study of correlation, Dr. Crampton investigated the following material: (a) 848 cocoons of *Philosamia cynthia*, (b) 1,410 cocoons of *Samia cecropia*, (c) 400 cocoons of *Callosamia angulifera*, etc., (d) 75 cocoons (preliminary) of *Attacus orizaba*, and (e) one family, *Hypercheiria io*.

The data secured furnished material for examination into variation and selection by comparing: (a) Metamorphosing and non-metamorphosing, (b) the perfect and imperfect survivors, and (c) the mating and non-mating moths.

Dr. Crampton thinks that certain general conclusions are justified from the facts already determined. Surviving individuals are less variable than those which succumb; mating individuals are less variable than those which fail to mate, and the index of correlation of the pupal characters is higher for the selected individuals in both cases. In a word, selection proceeds upon a basis of deviations from type and upon a correlative basis.

J. E. DUERDEN, Chapel Hill, N. C. *For investigation of recent and fossil corals.* \$1,000.

Abstract of Report. With a view to obtaining suitable material for continuing his researches on fossil corals, Dr. Duerden has lately visited the principal museums and geological surveys in Great Britain, where Paleozoic corals are most abundant. These museums, and also the Smithsonian Institution, have placed at his disposal numerous specimens. Other material has been purchased. These collections will be studied during the present winter, with the hope of showing the relationship of fossil to recent corals.

Dr. Duerden has deposited with the Carnegie Institution, with a view to its publication, the manuscript and drawings of a memoir entitled 'The coral *Siderastraea radians* and its post-larval development.' This work is illustrated by fifteen plates and numerous text figures and gives an account of the morphology of a coral and its growth for a period of four months. It carries the development of the coral much farther than any previous work and contains many fundamental results in madreporarian morphology.

C. H. EIGENMANN, Indiana University, Bloomington, Ind. *For investigating the blind fishes of Cuba.* \$1,000.

Abstract of Report.—Dr. Eigenmann did not begin his work under the Carnegie grant until October. He expects to spend from four to six months in Cuba, during the entire breeding season, and to make general collections in the caves and streams. He will also make an effort to secure the blind fishes from the island of Jamaica. He has made arrangements with the Cuban government to cooperate with him, as far as practicable, in giving him facilities for carrying forward his investigation.

L. O. HOWARD, Department of Agriculture, Washington, D. C. *For preparing manuscript and illustrations for a monograph on American mosquitoes.* \$2,000.

Abstract of Report.—Dr. Howard began his work by making arrangements to secure observers at points in the United States, Central America and the West Indies sufficiently different in their faunistic characteristics to promise comparatively little duplication. He also published an announcement of the proposed monograph for the purpose of attracting volunteer observers and contributors; and, through correspondence, a great deal has been done in that direction, both in the West Indies and the United States. He also utilized the services of a number of the members of his force in the Department of Agriculture in making collections and observations.

He reports that the results as a whole have been surprising to him. A number of new species of mosquitoes have been discovered and one new genus, and much important specific information regarding the geographic distribution of the different species has been gained. This information has been of special interest and value regarding the yellow fever mosquito (*Stegomyia fasciata*) and the different species of the malaria-bearing mosquitoes of the genus *Anopheles*. A new species of this genus was found in the immediate vicinity of Washington. Great advance has been made in following out the life histories of the different species and genera; this has been done for nearly one hundred species.

All the collections and specimens have not yet been received by Dr. Howard, but every observer will send a series of specimens of adults, eggs, larvæ and pupæ, together with cast larval skins of all species observed. These have been and will be accompanied by full notes of habits, etc., together with drawings of structural peculiarities.

H. S. JENNINGS, University of Michigan, Ann Arbor, Mich. *For experiments on the behavior of lower animals.* \$250.

Abstract of Report.—Dr. Jennings, who is a research assistant of the Carnegie Institution, is now at the Marine Biological Laboratory at Naples, carrying forward investigations on the reactions and behavior of very low organisms, such as amœba and other rhizopoda. He expects to have a general work in regard to the behavior of the lowest organisms ready for publication during the year. He has submitted to the institution for publication a paper entitled 'Reactions to Heat, Light and other Stimuli in the Ciliate Infusoria and in Rotifera, with Considerations on the Theories of Animal Behavior.'

C. E. McCLUNG, Kansas University, Lawrence, Kans. *To making a comparative study of the spermatogenesis of insects and other classes of arthropods, and if possible to determine the specific functions of the different chromosomes.* \$500.

Abstract of Report.—Professor McClung reports that owing to the fact that his own work and that of others show the main features of insect spermatogenesis, he determined to make use of the grant for the prosecution of other more difficult and expensive studies. He commenced by purchasing some literature to which he did not have access, and began the search for an object upon which he might prosecute his investigations. There appeared to be two ways to get at the problem—to study the germ cells of hybrids or to experiment upon fertilized eggs in the early cleavage stages. He decided to adopt the first mentioned plan for the beginning of the work. With this object in view, he spent the summer at the Woods Hole marine biological laboratory, but did not succeed in obtaining satisfactory forms of hybrids. He feels certain, however, that if the proper animals are secured the true function of the chromosomes may be settled as definitely as any other fact relating to cell structure.

E. B. WILSON, Columbia University, New York. *For investigations in experimental embryology, etc., in Naples.* \$1,000.

Abstract of Report.—Dr. Wilson utilized this grant to defray the expenses of a visit to the Naples Zoological Station, extending from February to July, during which time he was actively engaged on studies in experimental embryology. His first purpose was to search for available material for the experimental analysis of the early developmental stages in mollusks and annelids, which possess high theoretical interest in their bearings on the general problems of differentiation. He reports a large measure of success in this direction. He found two excellent objects for his research, and made as exhaustive an analysis of them as the time would permit. He demonstrated conclusively the mosaic character of the development in the molluscan egg, and obtained striking evidence of the self differentiation and specification of embryonic cells. This result is interesting from its bearing on the problem of differentiation and also, perhaps, in even a greater degree, through the firm basis which it gives for the general method and point of view in studies of cellular embryology.

A second general division of his work included the experimental study of prelocalization in the unsegmented egg, which yielded results of no less interest than the cleavage stages. Of these the most important relate to the embryonic basis of correlation and to the relation between quantitative and qualitative prelocalization in the germ.

Dr. Wilson adds a general comment on the nature of this work to the effect that its principal significance lies in its connection with recent studies of the cellular basis of inheritance and development, taken in connection with experimental studies of

heredity such as those that have grown out of the rediscovery of the Mendelian law. He is fully persuaded that there is now a very good prospect of making an essential advance toward an understanding of the actual mechanism of hereditary transmission, and expresses the hope that the studies in this direction may receive their due share of support.

H. V. WILSON, University of North Carolina, Chapel Hill. *For morphology and classification of deep sea sponges.* \$1,000.

Abstract of Report.—In order to complete his investigation of the deep sea sponges of the Pacific Ocean, Professor Wilson visited the museums of London, Paris, Leiden and Berlin to make a direct examination of the types stored therein. He returned to America in August, and is at present engaged upon the text of his report.

MARINE BIOLOGICAL LABORATORY, Woods Hole, Mass.; J. Blakely Hoar, treasurer. *For maintenance of twenty tables.* \$10,000.

Abstract of Report.—This appropriation was made for the purpose of aiding the laboratory by paying for the maintenance of twenty research tables. The persons assigned to the tables were selected by the Carnegie Institution.

The following investigators occupied the Carnegie tables during the season of 1903: (1) Professor M. A. Bigelow, Columbia University, N. Y.; (2) Dr. R. M. Strong, University of Chicago, Ill.; (3) Professor C. E. McClung, University of Kansas, Lawrence; (4) Professor George Lefevre, University of Missouri, Columbia; (5) Professor Wm. E. Kellicott, Barnard College, N. Y.; (6) Professor Arthur W. Greeley, Washington University, St. Louis; (7) Mr. C. J. Brues, Columbia University, N. Y.; (8) Mr. Fred. E. Pomeroy, Bates College, Lewiston, Me.; (9) Mr. J. W. Scott, Uni-

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versity of Chicago, Ill.; (10) Dr. H. G. Spaulding, College of the City of New York; (11) Dr. Leo Loeb, McGill University, Montreal, Canada; (12) Dr. Henry Kraemer, Philadelphia, Pa.; (13) Mr. Grant Smith, Harvard University, Cambridge, Mass.; (14) Professor Joseph Guthrie, Iowa State College, Ames, Iowa; (15) Miss A. B. Townsend, Cornell University, Ithaca, N. Y.; (16) Mr. M. A. Chrysler, University of Chicago, Ill.; (17) Mr. Gustav Ruediger, Chicago, Ill.; (18) Miss Helen Dean King, Bryn Mawr University, Pa.; (19) Mr. James A. Nelson, University of Pennsylvania; (20) Professor Christian P. Lommen, University of South Dakota.

The director of the laboratory, Dr. C. O. Whitman, reports that the entire number of investigators at the laboratory during the season was 130, of whom 54 were students and 76 original investigators. He further states that every worker at the laboratory shares the general advantage secured by the Carnegie Institution grant; that most of the occupants of the Carnegie tables were investigators of established reputation, a few of them fellows from different universities engaged in their first original work; that it is not expected that the work undertaken will come to publication immediately, as in most cases it will necessarily extend over two or three years; that it is anticipated that the Carnegie support will not encourage hasty and fragmentary production, but will secure thorough work and permanent results.

MARINE BIOLOGICAL STATION, Naples, Italy.

For maintenance of two tables. \$1,000.

Abstract of Report.—One of the tables at this station was occupied for three months during the spring by Dr. E. B. Wilson, of Columbia University, and the other by Professor H. S. Jennings, of the University of Michigan. The remainder of the year the tables were open to whomever

the director of the laboratory might wish to assign to them. The arrangement with the laboratory was that the tables were intended for the use of persons engaged in original biological researches, and carried with them the right to be furnished with the ordinary material and supplies of the laboratory.

STUDENT RESEARCH WORK IN WASHINGTON, \$10,000.

A special committee was appointed to consider the question of making provision for training in Washington students who desire to avail themselves of the various openings that may be offered to them. The executive committee, after full discussion, decided to place the report of the special committee on file, without action.

RESEARCH ASSISTANTS.

In pursuance of the policy approved by the trustees at their meeting in November, 1902, the sum of \$25,000 was set aside by the executive committee for the purpose of assisting a certain number of young investigators who have shown exceptional ability and desire to pursue special lines of inquiry, under the oversight of qualified guides, more or less authoritative, according to the circumstances of each case.

Announcement of this plan was made by a printed circular, which was published in the winter of 1902-1903, and addressed to the heads of universities, colleges, laboratories, and other scientific institutions.

In response to this announcement 127 applications were received. These were distributed according to the subjects of investigation and referred to the confidential advisers, whose written opinions were laid before the executive committee with accompanying papers. The persons below named were then selected: J. H. Bair, Columbia University, New York, N. Y.; J. W. Baird, Cornell University, Ithaca, N. Y.; A. J.

Carlson, Stanford University, California; C. D. Child, Colgate University, Hamilton, N. Y.; Arthur B. Coble, Lykens, Pa.; W. W. Coblentz, Cornell University, Ithaca, N. Y.; Lee H. Cone, University of Michigan, Ann Arbor, Mich.; Elias Elvove, Lexington, Ky.; Shepherd I. Franz, Hanover, N. H.; L. E. Griffin, Missouri Valley College, Marshall, Mo.; Ellsworth Huntington, Milton, Mass.; Herbert S. Jennings, Ann Arbor, Mich.; George D. Louderback, Reno, Nev.; Albert P. Morse, Wellesley, Mass.; C. P. Neill, Catholic University, Washington, D. C.; Hideyo Noguchi, University of Pennsylvania, Philadelphia; James B. Overton, Jacksonville, Ill.; H. F. Perkins, University of Vermont, Burlington, Vt.; H. N. Russell, Kings College, Cambridge, England; George W. Scott, University of Pennsylvania, Philadelphia; R. M. Strong, Haverford, Pa.; H. G. Timberlake, University of Wisconsin, Madison; J. B. Whitehead, Jr., Johns Hopkins University, Baltimore; E. J. Wilczynski, Berkeley, Cal.; F. S. Wrinch, Princeton, N. J.

One of the persons thus selected, Mr. H. G. Timberlake, died in July, 1903, and one of them, Mr. C. D. Child, did not accept the appointment on account of a change in his plans. From all the others satisfactory reports of progress have been received, which again have been referred to specialists for their scrutiny and comment.

PUBLICATIONS AUTHORIZED.

The publication of eleven scientific papers has been authorized.

1. 'The Collected Mathematical Works of the Astronomer,' George William Hill.
2. 'Desert Botanical Laboratory of the Carnegie Institution,' by F. V. Coville and D. T. MacDougal.
3. 'New Method for Determining Compressibility,' by T. W. Richards and W. N. Stull.
4. 'Waterlilies—a Monograph of the Genus *Nymphaea*,' by H. S. Conard.
5. 'Fecundation in Plants,' by D. M. Mottier.

6. 'On the Behavior of Lower Organisms,' by H. S. Jennings.

7. 'The Coral *Siderastrea*,' by J. E. Duerden.

8. 'Catalogue of Double Stars,' by S. W. Burnham.

9. '*Chimera*—a Memoir on the Embryology of Primitive Fishes,' by Bashford Dean.

10. 'Host Index of Fungi,' by W. G. Farlow.

11. 'Results of Investigations of Poison of Serpents,' by Drs. Simon Flexner and Hideyo Noguchi.

APPLICATIONS RECEIVED.

All applications, from the beginning to October 31, 1903, are summarized in the following table:

LIST OF APPLICATIONS RECEIVED FROM BEGINNING TO NOVEMBER, 1903.

Subject.	Applications.			Amount Asked For.
	Not Stating Amount Desired.	Stating Amount Desired.	Total.	
Agriculture . . .	3	1	4	\$5,000
Anthropology ..	26	18	44	90,083
Archeology	11	5	16	17,700
Art	10	10
Astronomy	21	37	58	567,750
Bibliography ..	15	12	27	82,250
Biology	14	1	15	100,000
Botany	28	32	60	138,300
Chemistry	37	52	89	90,500
Economics	38	8	46	72,500
Education	20	1	21	500
Engineering ...	20	5	25	24,040
Exploration ...	2	3	5	110,000
Fellowship	39	2	41	1,700
Foreign	7	8	15	17,000
Geography	1	2	3	1,500
Geophysics	3	9	12	33,250
Geology	21	16	37	145,800
History	30	9	39	101,400
Inventions	21	2	23	2,100
Literature	10	10
Mathematics ..	11	9	20	13,525
Medicine	35	11	46	16,325
Meteorology ...	2	6	8	32,750
Miscellaneous ..	25	7	32	68,200
Paleontology ..	5	5	10	11,900
Philology	12	1	13	750
Psychology	22	15	37	77,600
Physics	32	26	58	37,350
Physiology	23	20	43	30,975
Publication ...	37	18	55	90,250
Religion	9	2	11	37,000
Zoology	46	63	109	182,400
Total	636	406	1,042	\$2,200,398

GRANTS RECOMMENDED BY ADVISORY
COMMITTEES.

In addition, the advisory committees have submitted a number of recommendations not included in the foregoing table. These are printed on pages xxxiv-xxxv of the confidential report to the trustees, issued November 11, 1902, and that for the southern and solar observatories in the present report:

Physics, per annum.....	\$ 250,000
Geophysics, per annum.....	150,000
Psychology, per annum.....	45,000
Physiology, per annum.....	50,000
Southern Observatory, twelve years (\$820,000), first year.....	80,000
Solar Observatory, twelve to fourteen years (\$1,280,000), first year.....	150,000
History, per annum.....	17,500
Botany, per annum.....	24,000
Exploration, per annum.....	120,000
Geology, three years, per annum.....	25,000
Total	\$ 911,500
Adding this to the total amount in above summary	2,200,398
Gives a total of.....	\$3,111,898

The above total would have been still larger if all the grants had been made as requested. Frequently grants are requested for one year which, if made, would involve a number of subsequent grants before the completion of the work.

This is not intended as a close analysis of the amount of money desired. It merely shows the impossibility of making the present income of the Carnegie Institution provide for more than a small part of the grants requested.

Substantially all these applications have been carefully examined and considered. Many of the more important are explained in the first 'Year Book.'

Most of these applications have been considered unfavorably by the committee because they are not regarded as proper or useful purposes for expenditure from the income of the trust.

Some, however, have seemed to the committee only less important than the matters favorably reported upon, and these should, the committee thinks, be regarded as subjects of future consideration whenever available funds shall permit.

MEMBERSHIP IN THE AMERICAN
ASSOCIATION.

THE following persons have completed membership in the association since the publication of the last list of members, contained in Volume LII., Washington Proceedings, and corrected to June 15, 1903:

Albert, Harry Lee, professor of biology, State Normal School, Cape Girardeau, Missouri.

Allis, Edward Phelps, Jr., Palais Carnoles, Menton, France.

Anderson, William G., M.D., associate director, Yale Gymnasium, New Haven, Conn.

Ashton, Charles Hamilton, assistant in mathematics, University of Kansas, Lawrence, Kansas.

Avis, Edward S., Ph.D., president of the North Georgia Agricultural College, Dahlonega, Ga.

Bair, Joseph Hershey, Ph.D., Columbia University, New York, N. Y.

Baird, Robert Logan, Oberlin College, Oberlin, Ohio.

Balch, Alfred William, assistant surgeon, U.S.N., Navy Department, Washington, D. C.

Barek, Dr. Carl, 2715 Locust St., St. Louis, Mo.

Birge, Edward A., dean of the College of Letters and Science, University of Wisconsin, Madison, Wis.

Brown, George P., president of the Public School Publishing Co., Bloomington, Ill.

Blum, Sanford, M.D., 1243 Franklin St., San Francisco, Cal.

Cady, Hamilton Perkins, assistant professor of chemistry, University of Kansas, Lawrence, Kansas.

Cannon, W. A., Ph.D., Tucson, Arizona.

Clements, George E., M.D., 522 Capitol Ave., Springfield, Ill.

Comstock, Daniel F., 102 Huntington Ave., Boston, Mass.

Coombs, Zelotes Wood, professor of modern languages, Worcester Polytechnic Institute, Worcester, Mass.

Dozier, Melville, professor of mathematics and physical sciences, State Normal School, Los Angeles, Cal.

Easton, Christopher, deputy superintendent, Metropolitan Hospital, Blackwell's Island, New York, N. Y.

Ely, Robert Erskine, executive director, League for Political Education, 23 West 44th St., New York, N. Y.

Fox, Henry, 5603 Germantown Ave., Germantown, Philadelphia, Pa.

Frost, Arthur Barzilla, 33 Fay St., E. Cleveland, Ohio.

George, Russell D., professor of geology, University of Colorado, Boulder, Colo.

Gilchrist, John D. F., Ph.D., government biologist of Cape Colony, Department of Agriculture, Cape Town, South Africa.

Griggs, Robert F., professor of biology, Fargo College, Fargo, N. Dak.

Gruenberg, Benjamin C., teacher of biology, DeWitt Clinton High School, 60 West 13th St., New York, N. Y.

Harper, William R., LL.D., president of the University of Chicago, Chicago, Ill.

Harris, James Arthur, Shaw School of Botany, St. Louis, Mo.

Herzstein, M., M.D., 801 Sutter St., San Francisco, Cal.

Hoopes, H. E., Media, Pa.

Hotchkiss, Elmer Aro, president of Champaign County Board of School Examiners, Mechanicsburg, Ohio.

Hughes, Charles Hamilton, M.D., president of Barnes Medical College, 3857 Olive St., St. Louis, Mo.

Hulbert, C. E., secretary of department of anthropology, Louisiana Purchase Exposition, St. Louis, Mo.

Hurst, Julius H., M.D., 269 Canner St., New Haven, Conn.

Hutchinson, Susan A., librarian of the Museum of Brooklyn Institute of Arts and Sciences, Eastern Parkway, Brooklyn, N. Y.

Jones, Adam Leroy, Ph.D., tutor in philosophy, Columbia University, New York, N. Y.

Kasner, Edward, Ph.D., tutor in mathematics, Barnard College, Columbia University, New York, N. Y.

Kerr, William Jasper, D.Sc., president of the Agricultural College of Utah, Logan, Utah.

Kilgore, Benjamin Wesley, director of N. C. Agric. Exper. Station, Raleigh, N. C.

Landis, Edward Horace, instructor in physics and chemistry, Central High School, Philadelphia, Pa.

Lawrence, Florus F., chief of staff and surgeon, Lawrence Hospital for Women, Columbus, Ohio.

Levene, P. A., M.D., 1 Madison Avenue, New York, N. Y.

Livingston, Burton E., New York Botanical Garden, Bronx Park, New York, N. Y.

Lounsbury, Charles P., government entomologist, Cape Town, South Africa.

Low, Clarence F., Liverpool, London, Globe Building, New Orleans, La.

Lowe, Houston, Dayton, Ohio.

McCaustland, Elmer J., assistant professor of civil engineering, Cornell University, Ithaca, N. Y.

MacCracken, John H., president of Westminster College, Fulton, Mo.

McKay, John S., Packer Collegiate Institute, Brooklyn, N. Y.

Martin, Louis A., Jr., instructor in mathematics and mechanics, Stevens Institute, Hoboken, N. J.

Mayo, Caswell A., 1536 Fiftieth St., Brooklyn, N. Y.

Messenger, James F., professor of psychology, State Normal School, Winona, Minn.

Metcalf, Haven, professor of botany, Clemson College, S. C.

Miner, James B., instructor in psychology, University of Illinois, Urbana, Ill.

Mitchell, Guy E., secretary of National Irrigation Association, Washington, D. C.

Mojonnier, Timothy, care of Helvetia Milk Condensing Co., Greenville, Ill.

Moulton, W. H., assistant manager, Osborn Mfg. Co., Cleveland, Ohio.

Nutting, Perley G., National Bureau of Standards, Washington, D. C.

Pegram, George B., tutor in physics, Columbia University, New York, N. Y.

Porter, Fred. B., 4911 Champlain Ave., Chicago, Ill.

Ramsey, Miss Mary C., Shoshone Agency, Wyoming.

Rankin, J. M., Atlantic Building, Washington, D. C.

Reagan, Albert B., 327 S. Lincoln St., Bloomington, Ill.

Richardson, Leon B., instructor in chemistry, Dartmouth College, Hanover, N. H.

Riley, Mrs. Matilda E., art director, St. Louis Public Schools, Board of Education Building, St. Louis, Mo.

Rogers, Howard J., chief of department of education and director of international congresses, Universal Exposition, St. Louis, Mo.

Schober, Wm. Bush, Lehigh University, South Bethlehem, Pa.

Shurtleff, Eugene, M.D., 73 Hancock St., Dorchester, Mass.

Sinclair, Cephas Hempstone, Coast and Geodetic Survey, Washington, D. C.

Smith, Alton Lincoln, assistant professor of drawing and machine design, Worcester Polytechnic Institute, Worcester, Mass.

Spaulding, Perley, Missouri Botanical Garden, St. Louis, Mo.

Stewart, George Walter, professor of physics, University of North Dakota, Grand Forks, N. Dak.

Swift, Henry D., West Falmouth, Mass.

Thompson, Benj., chief engineer, T. & B. V. Ry. Co., Hillsboro, Texas.

Tiernan, Austin K., C.E., P. O. Box 441, Salt Lake City, Utah.

Torrey, Harry Beal, Ph.D., instructor in zoology, University of California, Berkeley, Cal.

Tower, Ralph Winfred, curator of physiology, Am. Mus. Nat. Hist., New York, N. Y.

Valentine, Morris Crawford, instructor in biology, High School, 259 West 131st St., New York, N. Y.

Veath, Arthur Clifford, U. S. Geological Survey, Washington, D. C.

Vogt, Frederick A., principal of Central High School, Buffalo, N. Y.

Wadsworth, Oliver F., 526 Beacon St., Boston, Mass.

West, Max, Ph.D., Treasury Department, San Juan, Porto Rico.

Wetherill, Henry Emerson, M.D., 3734 Walnut St., Philadelphia, Pa.

Whelpley, Dr. H. M., 222 South Broadway, St. Louis, Mo.

Woodruff, Lorande Loss, assistant in biology, Williams College, Williamstown, Mass.

Wrinch, Frank Sidney, Ph.D., instructor in experimental psychology, University of California, Berkeley, Cal.

Wylie, Robert Bradford, University of Chicago, Chicago, Ill.

SCIENTIFIC BOOKS.

General Zoology. Practical, Systematic and Comparative. By CHARLES WRIGHT DODGE. New York, American Book Company. Pp. 512; 379 figs.

As stated on the title-page, this work is a revision and rearrangement of Orton's 'Comparative Zoology.' It is evidently designed for elementary instruction in high schools, academies and colleges. About one third of the volume is devoted to a brief systematic review of the animal kingdom, the remainder to 'comparative zoology,' that is, a mixture of animal physiology, comparative anatomy, embryology, ethnology, distribution, etiology, etc. In the main, the work has been carefully written, though certain statements should be revised or corrected in a possible new edition. The insect figured as a cricket (*Gryllus*) on page 109 is a locustid, and the dragon-fly on page 111 is not a *Libellula*. The bird figured on page 172 is the resplendent trogon (*Pharomacrus mocinno*) and not *Trogon elegans*, which is a very different creature. Although the classification adopted is that of Parker and Haswell, the author includes the apocryphal group Mesozoa, at least in the 'ancestral tree' on page 201, though nothing is said about it in the text. *Amphioxus* is still regarded as a vertebrate, though this term is properly applicable only to the Craniota. In the chapter on the distribution of animals there are a few sweeping and inaccurate statements. On page 441 the author says: 'Each of the three great provinces, Earth, Air and Water, as also every continent, contains representatives of all the classes; but the various classes are unequally represented.' This sets one to wondering whether the American fauna may not comprise such things as flying tunicates and aerial holothurians, and whether terrestrial cyclostomes may not be discovered in the remoter regions of the 'dark continent.' In the chapter on the origin of animal species the definition of 'organic selec-

tion' is, to say the least, misleading. The word 'consciousness,' on the last page, is out of place in a text-book on zoology, especially when it is still a serious question whether this word should not be rigorously avoided even in works on comparative psychology. The binding, paper and typography are all that can be desired in a small work like that of Professor Dodge. The figures are clear, attractive and abundant. Perhaps there are proportionally too many figures of European and too few of American species, especially among the insects, for a book that will probably be more used in this country than abroad.

WILLIAM MORTON WHEELER.

SCIENTIFIC JOURNALS AND ARTICLES.

The Popular Science Monthly for December contains a careful discussion of 'Recent Theories in Regard to the Determination of Sex,' by T. H. Morgan, a history of 'The Academy of Science of St. Louis,' by William Trelease, and a description of 'The Tetrahedral Kites of Dr. Alexander Graham Bell,' by Gilbert H. Grosvenor. Dr. J. A. Fleming contributes the seventh and final paper on 'Hertzian Wave Wireless Telegraphy,' in which are presented some of the problems waiting for solution before it can be entirely successful. 'The Salmon and Salmon Streams of Alaska' are described by David Starr Jordan, the article containing an account of the food value of each species. 'The Storm Center in the Balkans,' by Allan McLaughlin, shows how the very mixed population of this region makes it a continual source of political trouble, while in 'The Growth of Rural Population' Frank T. Carlton shows the changes that have recently taken place in that direction. The concluding article, by the late R. H. Thurston, is on 'Rear-Admiral G. W. Melville, U.S.N., and Applied Science in Construction of the New Fleet.'

Bird-Lore for November-December contains 'An Island Eden,' by Frank M. Chapman, being an account of Gardiner's Island, N. Y.; 'The Turkey Vulture and Its Young,' by Thomas H. Jackson; the first of a series of articles on 'The Migration of Warblers,' by

W. W. Cooke, and the seventh series of portraits of *Bird-Lore's* Advisory Councilors. There are the usual notes and book reviews and reports of the Audubon Societies. This last includes 'Educational Leaflets,' No. 6, on the passenger or wild pigeon. It is announced that the papers on warblers will be illustrated by colored plates, and the present number contains two. Eventually the series will appear in book form.

The Journal of Comparative Neurology has somewhat enlarged its scope, and will hereafter be called *The Journal of Comparative Neurology and Psychology*. Professor C. Judson Herrick, of Denison University, will continue to be the managing editor, and Dr. O. S. Strong, of Columbia University, will continue to be one of the associate editors, while Dr. Robert M. Yerkes, of Harvard University, will become associate editor with special charge of the departments dealing with the functions of the nervous system and comparative psychology. A large board of cooperating editors has also been secured. The subscription price will hereafter be \$4, and the journal will hereafter appear bi-monthly, each volume containing about 500 pages.

PROFESSOR GUILIO FANO, of Florence, has decided to found a new periodical, to be entitled *Archivio di Fisiologia*. He will be assisted in the editorship by Professor Filippo Bottazzi, of Genoa. The *Archivio di Fisiologia* will especially concern itself with experimental work, but synthetic reviews and philosophical disquisitions will not be excluded. Papers will be published, according to the wish of the author, in one of the four official languages of the International Physiological Congress—English, Italian, German or French. The *Archivio di Fisiologia* will appear every two months, forming a yearly volume of about 500 pages.

The Museums Journal of Great Britain for November has papers on 'Copyright of Works of Art in the Museums of Great Britain,' by E. Ernest Lowe, which shows a very curious state of affairs; 'Early Monuments and Archaic Art of the Northeast of Scotland,' by W. M. Ramsay, and on 'Good Form in Nat-

ural History Museums,' by F. Jeffrey Bell. There are an interesting report of the meeting of the library association and many notes from various museums.

SOCIETIES AND ACADEMIES.

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES.

THE American Association for the Advancement of Science, the American Society of Naturalists and the following affiliated societies will meet at St. Louis, Mo., during the week beginning December 28.

The American Association for the Advancement of Science. The week beginning on December 28, 1903. President, The Hon. Carroll D. Wright; Permanent Secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; General Secretary, Dr. Chas. W. Stiles, U. S. Department of Agriculture, Washington, D. C.; Secretary of the Council, President Chas. S. Howe, Case School of Applied Science, Cleveland, Ohio. *Local Executive Committee,* President, Professor William Trelease; Secretary, Alexander S. Langsdorf.

Section A—Mathematics and Astronomy. Vice-president, O. H. Tittmann; Secretary, Professor L. G. Weld, University of Iowa, Iowa City, Ia.

Section B—Physics. Vice-president, Professor Edwin H. Hall; Secretary, Professor D. C. Miller, Case School of Applied Science, Cleveland, Ohio.

Section C—Chemistry. Vice-president, Professor W. D. Bancroft; Secretary, Professor A. H. Gill, Massachusetts Institute of Technology, Boston, Mass.

Section D—Mechanical Science and Engineering. Vice-president, Professor C. M. Woodward; Secretary, Professor Wm. T. Magruder, Ohio State University.

Section E—Geology and Geography. Vice-president, Professor I. C. Russell; Secretary, Dr. G. B. Shattuck, The Johns Hopkins University, Baltimore, Md.

Section F—Zoology. Vice-president, Professor E. L. Mark; Secretary, Professor C. Judson Herick, Denison University, Granville, Ohio.

Section G—Botany. Vice-president, Professor T. H. MacBride; Secretary, Professor F. E. Lloyd, Teachers College, Columbia University, New York City.

Section H—Anthropology. Vice-president, Professor M. H. Saville; Secretary, Dr. R. B. Dixon, Harvard University, Cambridge, Mass.

Section I—Social and Economic Science. Vice-president, Judge S. E. Baldwin; Secretary, J. E.

Crowell, U. S. Department of Agriculture, Washington, D. C.

Section K—Physiology and Experimental Medicine. President, Professor H. P. Bowditch; Secretary, Professor F. S. Lee, Columbia University, New York. There will be no meeting of Section K at the St. Louis meeting.

The American Society of Naturalists. December 29 and 30. President, Professor William Trelease; Secretary, Dr. Ross G. Harrison, The Johns Hopkins University, Baltimore, Md. *The Central Branch* of the society meets at the same time and place. President, Professor John M. Coulter; Secretary, Professor W. J. Moenkhaus, Indiana University, Bloomington, Ind.

The Astronomical and Astrophysical Society of America. December 29, 30. President, Professor Simon Newcomb; Secretary, Professor Geo. C. Comstock, Washburn Observatory, Madison, Wis.

American Physical Society. During convocation week. President, Arthur G. Webster; Secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society. December 28, 29. President, Professor John H. Long; Secretary, Professor W. A. Noyes, The Johns Hopkins University, Baltimore, Md.

The Geological Society of America. December 30, 31, 1903, January 1, 1904. President, Dr. S. F. Emmons; Secretary, Professor H. L. Fairchild, University of Rochester, Rochester, N. Y. *Cordilleran Section.* San Francisco. January 1, 2, 1904.

The American Mathematical Society—Chicago Section. Secretary, Professor Thomas F. Holgate, Northwestern University, Evanston, Ill. *San Francisco Section.* Berkeley, Cal. December 19. Secretary, Professor G. A. Miller, Stanford University, Cal.

Botanical Society of America. December 30, 31. President, B. T. Galloway; Secretary D. T. MacDougall, New York Botanical Garden, Bronx Park, N. Y.

The Central Botanists' Association. President, Conway MacMillan; Secretary, C. F. Millspaugh, Field Columbian Museum, Chicago, Ill.

The Botanical Club of the Association. Probably, at convenient times.

The Society for Horticultural Science. December 28, 29. President, Professor L. H. Bailey; Secretary, S. A. Beach, Geneva, N. Y.

The Fern Chapter. Time to be announced. President, B. D. Gilbert; Secretary, H. D. House, Botanical Garden, Bronx Park, New York, N. Y.

The Society for the Promotion of Agricultural

Science. December 28, 29, 30, 31, 1903, January 1, 1904. President, Dr. William Frear; Secretary, Professor F. M. Webster, University of Illinois, Urbana, Ill.

American Society of Zoologists, Central Branch. December 29, 30, 31. President, Professor Jacob E. Reighard; Secretary, Professor Frank Smith, University of Illinois, Urbana, Ill.

The Association of Economic Entomologists. December 29, 30. President, Professor Mark V. Slingerland; Secretary, Professor A. F. Burgess, Ohio State University, Columbus, Ohio.

The Entomological Club of the Association. At convenient times. President, E. A. Schwarz; Secretary, C. L. Marlatt, Department of Agriculture, Washington, D. C.

The American Microscopical Society. December 28, probably. President, T. J. Burrill; Secretary, H. B. Ward, Lincoln, Nebraska.

Association of Plant and Animal Breeders. First general meeting. December 29, 30. Chairman of Committee, W. M. Hayes, University Farm, St. Anthony Park, Minn.

The American Anthropological Association. December 28, 1903, January 1, 2, 1904. President, Dr. W. J. McGee; Secretary, George H. Pepper, American Museum of Natural History, Central Park, New York City.

The American Psychological Association. December 29, 30. President, Dr. W. L. Bryan; Secretary, Professor Livingston Farrand, Columbia University, New York City.

The Sigma Xi Honorary Scientific Society. During convocation week. President S. W. Williston; Secretary, Professor E. S. Crawley, University of Pennsylvania, Philadelphia, Pa.

The National Educational Association, Department Presidents. About January 1, 1903. President, John W. Cook; Secretary, Irwin Shepard, Winona, Minn.

There will meet at Philadelphia:

The American Society of Zoologists, Eastern Branch. December 29, 30, 31. President, Dr. G. H. Parker; Secretary, Dr. G. A. Drew, University of Maine, Orono, Me.

The Association of American Anatomists. December 29, 30, 31. President, Professor G. S. Huntington; Secretary, Professor G. Carl Huber, University of Michigan, Ann Arbor, Mich.

The Society for Plant Morphology and Physiology. December 29, 30, 31. President, Professor Roland Thaxter; Secretary, Professor W. F. Ganong, Smith College, Northampton, Mass.

The Society of American Bacteriologists. December 29, 30. President, Professor Theobald

Smith; Secretary, Professor E. O. Jordan, University of Chicago, Chicago, Ill.

The American Physiological Society. December 29, 30. President, Professor R. H. Chittenden; Secretary, Professor F. S. Lee, Columbia University, New York City.

There will meet at Princeton:

The American Philosophical Association. December 29 and 30. President, Professor Josiah Royce; Secretary, Professor H. N. Gardiner, Smith College, Northampton, Mass.

There will meet in New York:

The American Mathematical Society. Columbia University. December 28 and 29. President, Professor Thomas S. Fiske; Secretary, Professor F. N. Cole, Columbia University, New York City.

THE SOCIETY OF THE VERTEBRATE PALEONTOLOGISTS OF AMERICA.

At a meeting held at Washington, D. C., December 31, 1902, which was attended by the persons whose names are printed in italics in the list given below, it was decided to organize a society of the vertebrate paleontologists of America. Of this society Professor S. W. Williston, of the University of Chicago, was chosen president and O. P. Hay, of the American Museum of Natural History, secretary. It was further decided that the meetings of this society should be held at the same time and place as those of the American Society of Zoologists. The following active workers in vertebrate paleontology were proposed as original members: *G. I. Adams*, *E. H. Barbour*, *B. A. Bensley*, *B. Brown*, *E. C. Case*, *Bashford Dean*, *E. Douglass*, *C. R. Eastman*, *G. F. Eaton*, *J. Eyerman*, *M. S. Farr*, *S. Garman*, *J. W. Gidley*, *Theodore Gill*, *C. W. Gilmore*, *W. Granger*, *J. B. Hatcher*, *O. P. Hay*, *L. M. Lambe*, *J. Lindahl*, *F. B. Loomis*, *F. A. Lucas*, *W. D. Matthew*, *J. C. Merriam*, *H. F. Osborn*, *W. Patten*, *O. A. Peterson*, *E. S. Riggs*, *W. B. Scott*, *A. Stewart*, *J. F. Whiteaves*, *G. R. Wieland*, *S. W. Williston*, *J. L. Wortman*.

Notice is hereby given that a second meeting of the society will be held, beginning December 29, 1903, in Philadelphia, at the University of Pennsylvania, at which meeting the organization of the society will be completed and papers will be read by several

members. Titles of papers have already been received from Messrs. Adams, Case, Eastman, Hay, McGregor, Loomis, Matthew, Merriam, Osborn, Patten, Scott and Williston. It is earnestly desired that all who are interested in the progress of the science may be present. Communications regarding the meeting may be addressed to the secretary.

S. W. WILLISTON, *President*.

O. P. HAY, *Secretary*.

AMERICAN CHEMICAL SOCIETY. NORTHEASTERN
SECTION.

THE forty-seventh meeting of the section was held in the Lowell Lecture Hall, Massachusetts Institute of Technology, Friday, November 27, at 8 P.M.; President A. H. Gill in the chair. Seventy members were present.

The following officers for 1903-4 were elected:

President—W. H. Walker.

Vice-President—Henry Howard.

Secretary—A. M. Comey.

Treasurer—W. E. Piper.

Executive Committee—Henry Fay, H. A. Torrey, J. R. Marble, A. E. Leach and W. K. Robbins.

Councillors—John Alden, C. R. Sanger, H. P. Talbot.

The treasurer's and auditor's reports were presented.

President A. H. Gill reviewed the history of the section during the past year, and gave an address on 'Some Limitations of Technical Analysis,' showing some of the difficulties in the detection and separation of substances which have not yet been overcome.

Dr. Peter S. Burns followed with a paper entitled 'Some Experiments on Colloids,' showing by numerous experiments the various methods of preparing colloidal solutions, and their behavior under different conditions and with different reagents. The lecturer also described the various theories that had been proposed to account for the phenomena observed, and propounded a new theory as a tentative explanation of the same.

ARTHUR M. COMEY,
Secretary.

SPECIAL MEETING OF THE WASHINGTON CHEMICAL
SOCIETY.

A SPECIAL meeting of the Washington Chemical Society was held in the chemical lecture room of the Columbian University at 8 P.M., November 23, 1903, for the purpose of taking appropriate action upon the death of Dr. H. Carrington Bolton.

The meeting was called to order by the president, who made a few remarks concerning the Christian spirit, gentlemanly conduct and unique work of the late Dr. Bolton. Dr. Cameron was followed by Professor Monroe, who read from the 'Bolton Genealogy,' which contained a short history of the life of Dr. Bolton, and was compiled by Dr. Bolton and his cousin. The account of Dr. Bolton's life showed him to have received exceptional educational advantages, having studied with such men as Bunsen, Wöhler, Von Hoffman and others. He traveled extensively. He taught at the School of Mines of Columbia College and held the chair of chemistry at Trinity College of Hartford, Conn., for ten years. He strove to impart knowledge in an attractive way. He is the author of more than one hundred and fifty scientific and literary contributions.

Dr. Marcus Benjamin then responded with a few recollections of his extended acquaintance with Dr. Bolton, and called especial attention to the enthusiasm with which Dr. Bolton undertook any work in which he became interested.

Dr. Clarke recalled a number of instances in the course of his friendship with Dr. Bolton. He emphasized particularly the value of Dr. Bolton's work upon the bibliography of scientific literature.

Dr. Wiley then spoke of his associations with Dr. Bolton, especially with reference to his knowledge of him as a man. He mentioned particularly his personality, his geniality and verity of friendship, sincerity and simplicity of mind and character.

Remarks were also made by Professor Long, president of the American Chemical Society, and also by Dr. Warder.

Letters of regret and personal interest in the motive of the meeting were received from

Dr. David W. Day, Mr. William Glenn, of Baltimore, and others.

In response to the formal motion made and carried, the president appointed a committee consisting of Professor Munroe, Dr. Clarke and Dr. Wiley to draft resolutions expressing the loss felt by the Washington Chemical Society in the death of Dr. Bolton.

A. SEIDELL, *Secretary*.

SHORTER ARTICLES.

SOME OSTEOLOGICAL TERMS.

IN the usual osteological nomenclature, there are certain terms, among others, which have been and yet are so loosely and indefinitely used that one is often in doubt as to their meaning. I refer more especially to 'hæmapophysis,' 'hæmal spine' and 'hypapophysis.' The first two of these were proposed by Owen in the *Geological Transactions*, Vol. V., p. 118 (1838). 'Hæmapophyses' was there defined and used as a synonym of 'chevron-bones'—“These are the chevron-bones of Mr. Conybeare, the paravertebral elements of Geoffroy St. Hilaire.” In later years, especially in his 'Archetype and Homologies of the Vertebrate Skeleton,' Owen extended the meaning of the word to include the ischium, pubis, costal cartilages, etc., and he correctly suggested it for the intercentrum of the atlas in 1851. Cope in his posthumous work upon the lizards and snakes of North America uses hæmapophysis as a synonym of rib. As applied to the chevron-bones, the word is unnecessary, and, as extended to the other structures in Owen's transcendental theory, the term is inapplicable and mischievous. As is well known, the 'hæmapophyses' of fishes are formed chiefly by the deflection of the parapophyses, while the chevrons of reptiles are supposed to be of intercentral origin alone. Unfortunately, the phrase 'hæmal arch' has also had a very indefinite application, but its use is preferable to that of 'hæmapophyses.' In any event, I quite agree with Boulenger that the latter word should be banished utterly from anatomical nomenclature. The word chevron has become well fixed, and has, moreover, the advantage of being morphologically meaningless.

'Hæmal spine' was first proposed by Owen to indicate the spine of the united chevron. In this application among fishes it has a definite morphological meaning, though not often now so used. The term helped Owen to round out his symmetrical archetype of the vertebra, but, when he later applied it to so incongruous an assemblage of morphological elements as the sternum, episternum and hyoid, as well as the intercentra of the Squamata, it loses every particle of meaning it may have once had and should be discarded. Boulenger, however (*Proc. Zool. Soc. Lond.*, 1891), has proposed to use the phrase in a totally different sense from any suggested by Owen for the infracentral keel or spine of such vertebræ as those of the turtles, rabbits, etc.

Concerning 'hypapophyses' there is ground for differences of usage, yet I think it may be shown that the word should be restricted to those processes only which Boulenger would call hæmal spines. The term was not proposed by Owen until some time after he had formulated his archetypal theory, appearing, I think, for the first time in his 'Skeleton and the Teeth,' published in 1853 or 1854, where it was defined. It seems clear from this definition, as also from his discussion of the vertebra in his 'Archetype and Homologies,' that he intended the word primarily for infracentral exogenous processes. He calls the hypapophysis exogenous, but says it may sometimes be autogenous, like 'the diapophysis and the parapophysis.' As we now restrict the latter two terms solely to exogenous processes, the former should be also. Boulenger, however, prefers to apply the term to the autogenous elements alone, that is to the intercentra and chevrons, and so uses the word as a synonym of 'intercentrum.' Baur, apparently following Boulenger, in 1894 (*Proc. Nat. Mus.*) invented the term 'catapophysis' for what was evidently originally meant by hypapophysis, and what is called hæmal spine by Boulenger, and accepted hypapophysis in place of intercentrum.

Cope was the first to use the term intercentrum in the sense now employed for the hypaxial element in the amphibia and reptiles. The element in question, however,

had previously been called Zwischenwirbelbein by Von Meyer in *Sphenosaurus*, and, long before, Egerton, in 1836, had proposed the phrase 'subvertebral wedge-bone' for the same element in the ichthyosaurs. It may be of interest to observe that Marsh, as early as 1878 (*Amer. Journ. Sci.*, May), correctly recognized his 'intercentral bones' in the so-called hypapophyses of the Mosasaurs, though Boulenger, as late as 1891, denied their identity. Hypapophysis is yet frequently used for the intercentrum of the atlas, following Owen, and 'hypocentrum,' 'basiventral bone,' etc., are frequent and superfluous synonyms of intercentrum.

There is yet another anatomical term which bids fair to become confused in its application—splenial. Owen proposed the term ('Arche-type and Homologies,' p. 15) in place of the Cuvierian 'opercular,' a term inadmissible because of its double use in the fishes, for the splint-like element on the inner side of the mandible, and figured as typical of the mandible in the crocodile and ostrich. Baur, correctly, I believe, recognizing that the so-called splenial of the turtle is not morphologically identical with the splenial in the crocodile and lizard, but rather a dermal element separated from the articular, gave to it (improperly, I think) the name of angular, while the real angular he called the splenial, and for the real splenial he proposed the new name 'pre-splenial.' Lambe, recently, in his description of the mandibular elements in *Dryptosaurus*, retains the names previously used in the turtles, but calls the most anterior element, sometimes also present in the turtles, the pre-splenial. But, this is inadmissible. There can be little if any doubt but that the pre-splenial of *Dryptosaurus* and the testudinales is morphologically identical with the real splenial of the crocodiles and the lizards, and it must receive the same name. If we call it the presplenial, then Baur's arbitrary change of the angular must also be accepted, otherwise the crocodile, to whose mandible the name splenial was originally applied, is juggled out of a splenial entirely!

S. W. WILLISTON.

UNIVERSITY OF CHICAGO.

THE ORIGIN OF FEMALE AND WORKER ANTS FROM THE EGGS OF PARTHENOGENETIC WORKERS.

DZIERZON'S celebrated theory, according to which the unfertilized eggs of the honey-bee give rise to males, or drones, whereas fertilized eggs develop into females (queens or workers), has not only become one of the established tenets of apiculturists, but has also been expanded by theorists to include other social insects, such as the ants and social wasps. Nor is this expansion merely the result of a tempting analogy. Forel* and Lubbock† long ago showed that the eggs of parthenogenetic worker ants may develop into males, and more recently similar observations have been made by Miss Fielde‡. These facts certainly confirm the Dzierzon theory and appear to justify its extension to the ants.

The further question, however, as to whether the unfertilized eggs of bees and ants may not, under certain conditions, give rise to workers, is still unanswered.§ In other words, the observation of a number of cases in which males developed from unfertilized eggs, is not in itself sufficient to preclude the possibility of the development of females or workers from such eggs under other circumstances. We know that this possibility is realized in the autumn broods of plant-lice, water-fleas, etc. That it may also be realized in ants is shown by the following observations made independently by three different observers and here quoted as a basis of suggestion for future experimental work. It is, perhaps, timely to stress these observations, for theorizing on sex determination is much in vogue and is being indulged in by some who seem to derive their facts from any but the original sources. That some of these observations have been 'snowed under'—*todtgeschwiegen*, as the Germans say—is not a matter of surprise when we consider the blinding

* 'Les Fourmis de la Suisse,' 1874, pp. 328, 329.

† 'Ants, Bees and Wasps,' London, 1888, pp. 36-40.

‡ 'A Study of an Ant,' *Proceed. Acad. Nat. Sci. Phila.*, July, 1901, p. 439.

§ See also Pérez, 'Mémoire sur le Ponte de L'Abeille Reine et la Théorie de Dzierzon,' *Ann. Sc. Nat.*, 6 ser., Tome VII., Art. 18, 1878, pp. 1-22.

effects of a brilliant theory like that of Dzierzon, backed by the weighty argumentation of a von Siebold, and the way it flatters our ineradicable tendency to formulate, conceptualize and schematize in advance of all exhaustive study of nature's processes.*

I find the following observations on a fungus-raising ant, the 'Sauba' (*Atta cephalotes*) of Trinidad, recorded by Tanner:†

My 'B' nest had neither queen nor male when it was set up on the 4th July; a few larvæ and pupæ were put into the nest at starting. The last of these became an ant on the 14th August, 41 days after capture.

The first eggs were seen 19 days after the capture, viz., on the 23d July. Very many small, medium-sized and large ants were matured from these eggs before its [the nest's] destruction on the 6th November, in periods of from 57 days for the smallest to 74 days for the larger ones. On the 20th October a male was matured, on the 3d November there were 25 males. On the 2d November a queen was matured, and another on the 5th, three days later, and their period was about 84 days. Thus, there are about 10 days for the egg, as a larva it varies from 27 days for the smallest workers, 44 days for the ordinary workers and 54 for males or queens and 20 days for the pupa stage. * * *

It is, therefore, as far as this experiment goes, conclusive, that workers, taken as these were from a nest which had been living in community

* Absence of critical caution in accepting the Dzierzon theory is seen, for example, in works like Castle's 'Heredity of Sex,' when the author makes the following apodictic statement (p. 191): 'That the spermatozoon also bears sex is manifest in the case of animals like the honey-bee, for the egg of the bee, if unfertilized, invariably develops into a male, but if fertilized into a female. Professor T. H. Morgan, in his recent work, 'Evolution and Adaptation,' pp. 424, 425, makes a similar statement: 'In the honey-bee all the fertilized eggs produce females and the unfertilized eggs males'; although he proceeds to cite the conditions in an insect of the same natural order as the bees and ants, namely the currant-fly (*Nematus ribesii*), which may, under certain conditions, produce both males and females from parthenogenetic eggs.

† *Ecodoma cephalotes*. Second paper. Trinidad Field Naturalists' Club, Vol. I., No. 5, December, 1892, pp. 123-127.

with males, do lay eggs, and that from them they can produce males and queens.

Tanner's observations go to show that the eggs of *Atta cephalotes* workers may give rise to ants of all three sexual forms, that is, males, females and workers of the different castes so remarkably developed in these large fungus-raising ants. The implication in the last quoted paragraph, that the production of all these forms depended on the fertile workers having come from a colony containing males, may be gratuitous (*vide infra*).

More important observations on this subject have been recently made by H. Reichenbach, a very conscientious worker.*

I quote his results in full:

In the spring of 1899 I placed in an empty artificial nest of the Janet pattern eleven workers of *Lasius niger* L., more for the purpose of showing my pupils the commonest of our ants, than for the purpose of conducting definite observations. I fed them with invert sugar and hashed meal-worms. Even after a few days I noticed several packets of eggs which had been laid by the workers. This was nothing new to me, and I expected that to happen which had happened in my other colonies, namely, that the larvæ hatching from such eggs would succumb to the cannibalism of the ants. At most I supposed that I might obtain males, since it has long been known that males arise from unfertilized eggs laid by workers, as in the case of the honey-bee and the social wasps.

But to my astonishment, the larvæ pupated and produced *typical workers*, which agreed with their progenitrices even in size. A few days later they had acquired their mature coloration and began to take part diligently in the labors of the colony.

Thus it is possible that workers may develop from unfertilized eggs laid by workers.

A little later the number of egg-packets increased, and towards the end of June the number of workers had risen to over a hundred, and a number of larvæ and pupæ were being busily carried about, assorted, fed and licked; the ants' appetite was excellent, the glass manger was found licked clean every morning; pupa-cases,

* 'Ueber Parthenogenese bei Ameisen und andere Beobachtungen an Ameisenkolonien in künstlichen Nestern,' *Biol. Centralbl.*, 22. Bd., 1902, pp. 461-465.

remains of meal-worms, etc., were very neatly piled up in a particular corner of the middle chamber;—in brief, the life and activity of the ants were perfectly normal, notwithstanding the rather peculiar provenience of most of the inmates of the nest.

During the normal course of colonial life the following occurrences were noticed:

During the last week of August, as it were on the very day, when in the gardens and streets of Frankfurth, winged males and females of *Lasius niger* creep about as weary relicts of the nuptial flights, about a dozen fine, shining males hatched in my colony. When they had taken on their adult coloration, they sought the illumined chamber and walked about nimbly. Had it been possible for them to escape, they would certainly have joined in the nuptial flight of the mass of their species out-of-doors.

The males lived only a few weeks; most of them met with an accidental death through becoming glued down with their wings.

The colony passed the winter in good condition, and in the spring of 1900 a rapid increase again took place from eggs laid by the workers. On the 1st of August I was able to announce to our natural history society that the nest again contained 300 workers and two to three dozen males. This year, also, the appearance of the males coincided with the swarming time out-of-doors.

During the year 1901 the same events were repeated, with the difference that the number of individuals had fallen off; still there were a few males towards the end of July. By the spring of 1902 only about twenty workers survived; larvæ were still being reared, but towards the end of April, for some unknown reason, the whole colony became extinct.

Worthy of note, therefore, is the coincidence, three times in succession, in the appearance of males at the typical time of swarming for our neighborhood. From this we must conclude that the conditions in my colony did not depend on degenerative or similar causes. On the contrary, this decided periodicity points to normal processes, which probably also occur in wild colonies, whose workers, in all likelihood, take part in producing males. Of course, these conditions require further investigation.

He who takes for granted the completeness of our knowledge of propagation in ants, more particularly of mating and fertilization, will regard all the workers of my *Lasius* colony as having developed from unfertilized eggs. But the question arises, whether, after the males made

their appearance, some kind of copulation could not take place within the nest, or whether, in fact, some of the eleven workers that founded the colony were not fertilized. Many will deny this with indignation and horror; but one is becoming accustomed to surprises, especially in sexual phenomena. Moreover, fertilization always occurs normally within the nest in the case of *Anergates atratulus* Schenck, which exhibits strict in-and-in breeding. Forel also opens up this question ('Les Fourmis de la Suisse,' p. 401). At any rate, a careful anatomical and microscopic analysis of the ovipositing workers, which are perhaps to be regarded as ergatogynous females, and their eggs, is in every respect important, and this alone would give value to the above observations.

That Reichenbach's supposition of a fertilization of the workers by their male progeny in his nest is unnecessary, is shown by the following observations kindly sent me by Mrs. A. B. Comstock, and published with her consent:

About the middle of August I colonized some ants of the species *Lasius niger* L. var. *americanus* Emery, in a glass nest in my room for the purpose of giving my pupils in nature study an opportunity for observing the habits of ants. I found this species common under the stones on a dry side hill, and I brought in, with the workers, pupæ and larvæ of two sizes and some eggs still unhatched. My prisoners soon put their nest in order and placed the pupæ in two separate heaps, and separated the larvæ into two groups according to size, and also placed the eggs by themselves. After a day or two the eggs hatched and these young larvæ were kept in a group away from the others. A few days later more eggs appeared. I at once looked for the queen but found none. No one ant in my colony was any larger than her sisters, and I was mystified as to the source of these eggs. However, they continued to appear; and there have been reared in this nest up to date at least three complete broods. We naturally expected that the eggs which were evidently laid by workers would produce males as is the case with bees. But this theory was wrong, for all the eggs laid by the workers in this nest have developed into workers. I have never been able to observe the actual process of egg laying. I am rather inclined to believe that the eggs were usually produced during the night. There was nothing in actions or appearance that enabled me to distinguish the egg-laying indi-

viduals from their sisters. I have noticed that when eggs were being produced a large number of the ants were crowded together in one corner of the nest, and only a few seemed to be on duty as nurses. Whether this segregation has to do with the egg laying or not I do not know.

In this case no males have as yet made their appearance. So accomplished an entomologist as Mrs. Comstock could not have overlooked either these or a queen in her colony, especially as the latter sex in *Lasius* is very much larger and more conspicuous than the worker.

While the observations above quoted are by no means final, they are, nevertheless, of sufficient value to call a halt to all speculation based on the Dzierzon theory formulated in the usual text-book style. As thus expressed this theory can at most be valid for the honey-bee only. The probability that worker ants can really produce other workers or even queens parthenogenetically is of ominous import, not only to some current views on sex determination, but also to many fine-spun theories of instinct and organic development. It has been generally admitted that worker insects have their own specific instincts (a proposition not strictly true, as I have endeavored to show,* since the instincts of the queen ant include all or nearly all the important worker instincts), and that these insects are smitten with such complete sterility as to be absolutely incapable of transmitting their inherited or acquired psychical or physical characteristics. Hence, it is urged, we can explain the existence of these worker traits only by resorting to a natural selection among the queens as bearers of characters which they do not themselves exhibit or exercise. Hence the additional sets of ids, etc., hypostasized in the germ-plasma of the queens. Or, if we have an innate repugnance to natural selection, we are requested to fall back on something like orthogenesis, some Aristotelian principle of perfectibility or Naegelian 'Vervollkommnungsprincip.' But after reveling in this tenuous atmosphere of hypothesis, which I would be the last to deprecate, since it is the only free playground of the living

* 'The Compound and Mixed Nests of American Ants,' *Am. Naturalist*, 1901, p. 798.

and struggling scientific imagination, are we not now bound to return to the cold facts and the drudgery of experiment and observation, if only to gain strength for another flight?

WILLIAM MORTON WHEELER.

AMERICAN MUSEUM OF NATURAL HISTORY.

QUOTATIONS.

THE CARNEGIE INSTITUTION.

THE trustees of the Carnegie Institution held their second annual meeting at Washington on December 9. Nothing that has become known in regard to this meeting will tend to allay the anxiety with which men of science are watching the administration of this great trust. It is reported that Dr. Gilman presented a letter to the trustees announcing his intention to resign the presidency at the close of next year. The institution will consequently drift along for another year, and its immediate future will in large measure depend on the president then chosen. There is no reason to doubt the ultimate outcome, and even the present conditions are only what might have been expected. Special creations are no longer regarded as feasible. The reply may be called to mind of the little boy, who, on being asked who made him, said 'God made me one foot big, and I grewed the rest.' A new foundation such as Mr. Carnegie's can only gradually become a true organism adjusted to the environment.

Mr. Carnegie's original plan of establishing a research university at Washington was comparatively plain sailing. The trustees are now divided as to policy, some wishing to establish certain laboratories at Washington, and others preferring to distribute subsidies throughout the country. The latter plan has been adopted; it has the obvious advantage of not committing the institution as to the future. No special objection can be made to the way the subsidies have been allotted. It is quite certain, for example, that the Harvard, Lick, Yerkes, Dudley and Princeton observatories can spend to advantage any money that may be entrusted to them. Almost any grant for research made to men of science of established reputation will bear fruit a hundredfold.

There is, however, an obverse to the shield. Such grants inhibit individual initiative and local support; they are likely to produce a certain subserviency to the powers that deal out money, and may lead to jealousy and intrigues.

It is perhaps scarcely fair to object to a board of trustees consisting chiefly of prominent politicians, lawyers and business men, who meet once a year, and can not be expected to give much attention to the affairs of a scientific institution, nor to have much knowledge of its scope and possibilities. Such boards are an established American institution, controlling universities, banks, etc. Their principal duty is to select efficient officers of administration. But the Carnegie Institution has been unfortunate in its first officers. Three men were largely instrumental in persuading Mr. Carnegie to make the original gift, and they have assumed control of its administration. This triumvirate has been at the same time autocratic and feeble, and has by no means worked in harmony. Antony may be supposed to say to Octavius:

And though we lay these honors on this man,
To ease ourselves of divers sland'rous loads,
He shall but bear them as the ass bears gold,
To groan and sweat under the business,
Either led or driven, as we point the way;
And having brought our treasure where we will,
Then take we down his load, and turn him off.
Like to the empty ass, to shake his ears,
And graze in commons.

Whether after the ensuing war Antony, Octavius or another will or should become Cæsar need not here be considered; but in the meanwhile and perhaps thereafter science will suffer. The fundamental difficulty is that no method has been found for consulting the consensus of opinion of scientific men. An American university has an absentee board in nominal control and a president as benevolent despot; but there is a faculty, which after all is the real university. The Carnegie Institution has no similar body; and until it is formed, it will drift along without compass or rudder.—*The Popular Science Monthly*.

THE RHODES SCHOLARS.

MR. W. S. MACGOWAN, Principal of St. Andrew's College, Grahamstown, Cape Colony, writes to the *London Times*:

In the *Times* weekly edition of September 25 you print a letter from 'South Africa' dealing with Dr. Parkin's proposal to select the Rhodes scholars from students who shall have pursued a two years' course at some American or colonial university.

When Dr. Parkin was in Grahamstown a short time ago, he explained his views at some length, but he was careful to tell his audience that they were only partially formed and necessarily incomplete, inasmuch as his colonial tour was not yet finished, although he had completed his investigations in the United States. I think that, when Dr. Parkin comes to present his report to the Rhodes Trustees, it will be found that it is America rather than the Colonies which will be found making this demand. To quote Dr. Parkin's own words to me: "The American professors deprecate any denationalization of their young men." This is, of course, quite right and perfectly natural, but surely in a British colony such a consideration as this is somewhat lacking in weight. I have not yet seen Mr. Hawksley's letter, and only know from Reuter that he has written one on this subject; but, apart from the legal aspect of the question, with which he is so amply qualified to deal, there are several reasons against tinkering with the plan that Mr. Rhodes evolved with a view to securing that his scholars should be *bona fide* undergraduates. The first of these is a financial one.

If the suggestion now being canvassed were universally adopted, viz., that every candidate for a scholarship should take a preliminary two years' course at his home university before proceeding to Oxford, there would instantly be swept from the field all boys whose parents could not afford for them more than an ordinary secondary education. There are many in this colony who could never go to Oxford at all if they were compelled to spend two years at the Cape University first.

Again, if the trustees agree to extend the usual university age in the case of Rhodes scholars, they will be running counter to Mr.

Rhodes's vigorously expressed desire that these young men should have the benefits of the influences of Oxford University at 'the most critical period of their lives.' If their characters are already formed, they are far more likely to alter the tone of Oxford than Oxford is likely to develop them.

Now, as to the desirability of this I offer no comment, I am only concerned with Mr. Rhodes's intention. He desired that poverty, religion, race—nay, even the lack of 'scholarship' itself—should not bar a boy of strong physique and moral character from obtaining one of these splendid prizes. Yet here is a scheme apparently gaining ground where poverty and the lack of scholarship will practically disqualify a candidate, and the application of the character test as outlined by the testator is rendered nugatory.

But it may be said that Mr. Rhodes only defined his ideas in respect of the South African scholarships. That is quite true, but he gave his intimates to understand that his motive was the same in all cases, viz., 'uniting of the Anglo-Saxon race.' That unity will be postponed if educational experts, in their very natural desire to secure the benefit of these great endowments to produce scholars, arrange the regulations in such a way as to eliminate possible leaders of men such as Rhodes was himself. He wanted picked potentialities, but, if I understand his mind aright, they were to be men of action rather than scholars.

RECENT ZOOPALEONTOLOGY.

VERTEBRATE PALEONTOLOGY IN THE UNITED STATES GEOLOGICAL SURVEY.

THE following abstract is published with the permission of the Geological Survey and covers the progress which has been made during the year 1903 on the work which was substantially begun July 1, 1882, by the appointment of Professor Othniel Charles Marsh, of Yale University, as paleontologist on the survey. As is well known, Professor Marsh devoted years to the collection and preparation of materials for a series of elaborate monographs. The work on these was most unfortunately interrupted by his death, but at that time

lithographic plates of three monographs, namely, the Brontotheriidae (60 plates), the Sauropoda (90 plates) and the Stegosauria (54 plates), were completely prepared and printed, together with hundreds of text illustrations. The drawings for the fourth monograph, the Ceratopsia, are on stone but not as yet printed. Practically none of the manuscript for these volumes was ready.

In appointing Professor Henry F. Osborn as Professor Marsh's successor, it was understood that the latter should receive full credit for the years of labor which he devoted to these monographs. The appointment of Professor Osborn was originally as paleontologist, June 30, 1900; in January, 1901, the appointment was changed to geologist and paleontologist.

The unfinished work was begun at once, and has been carried on in two lines: First, the preparation and supervision of the four paleontological monographs; second, the planning of geological field work connected therewith, the latter being of great importance, in order that the vertebrate paleontology of the survey may render service in connection with the stratigraphic history of the continent.

Professor Osborn undertook the preparation of the Titanotheres and Sauropoda monographs himself; Mr. J. B. Hatcher, now of the Carnegie Museum, was entrusted with the preparation of the monograph on the Ceratopsia; and Mr. F. A. Lucas, now of the United States National Museum, was entrusted with the preparation of the Stegosauria monograph.

More in detail, the actual work on hand and accomplished is as follows:

1. *Titanotheres Monograph*.—This monograph, begun January 2, 1901, has required more time than was anticipated, partly due to Professor Osborn's interruptions by other duties, partly to the unexpected expansion of the subject by the discovery, both in the Oligocene and Eocene, that the titanotheres embraced at least four entirely distinct and independent phyla. To learn the origin, history, succession and extinction of these animals it has become necessary to trace the materials scattered through many museums, at home and abroad. Yale, Princeton, Harvard, Ot-

tawa, Chicago, Washington and Pittsburg museums have been repeatedly visited. Mr. W. K. Gregory was sent to the British Museum of Natural History, London, for a special study of the titanotheres material there, and work has also been done through the aid of Dr. Max Schlosser, in Munich. The chief results obtained thus far are: (1) The systematic revision of the entire group of titanotheres; (2) the separation of the contemporaneous phyla above referred to, illustrating the law of local adaptive radiation, and the polyphyletic division of the perisodactyls; (3) the establishment of the law of correlation of skull with skeletal structure; (4) the independent development of the horns in three separate Eocene phyla, illustrating the law of predeterminate evolution. New methods of illustration in photography have been developed especially for this volume, under the direction of Mr. A. E. Anderson.

A special geological expedition to the Fort Bridger Beds, under the direction of Dr. W. D. Matthew, assisted by Mr. Walter Granger, during the summer of 1902, laid the foundation for more exact stratigraphic data concerning the distribution of species, both of the titanotheres and of other mammals. This preliminary survey in a measure tends to replace the lake theory of deposition in the Bridger beds by the flood plain theory already advocated by Professor W. M. Davis. If confirmed, it will give a further blow to the long-prevailing 'lake basin theory,' which, during the previous season, was unsettled in the Oligocene beds by the observations of Mr. J. B. Hatcher and Professor Eberhard Fraas, in connection also with this titanotheres monograph. A party from the American Museum, under the direction of Mr. Walter Granger, is now continuing the observations begun last season on the Bridger stratigraphy, and when these results are in, Dr. Matthew will be able to present his report.

2. *Ceratopsia Monograph*.—The assignment of this monograph to Mr. J. B. Hatcher is particularly appropriate, because of the fact that he practically discovered these animals while working for Professor O. C. Marsh under the U. S. Geological Survey; and that the

entire collections in the National Museum and the Yale University Museum are due to him. Mr. Hatcher has completed the bibliographical and reference section, as well as the preliminary revision of the principal forms of the *Ceratopsia*, and has reached very interesting and novel results. By the terms of his agreement with the Survey, materials in the Yale University Museum, through the cooperation of Professor C. E. Beecher, have been further prepared for description; also, materials in the U. S. National Museum and in the American Museum of Natural History.

The necessity of more exact stratigraphic work than that already contained in the previous studies by Cope, Hatcher and others of the vertebrate paleontology of the Cretaceous became apparent in 1902 partly through the studies by Professor Osborn and Mr. Lawrence M. Lambe, under the Canadian Geological Survey, on the fauna of the Belly River region in the Northwest Territory.*

From these it appeared that the union of the Judith River and the Laramie by Cope and Marsh was partly, at least, erroneous, that two distinct vertebrate faunæ were represented, that part of this fauna in Montana, as well as in the Northwest Territory, was older than the Fort Pierre beds. The subject caused widespread interest and discussion. Never was the necessity of the union of accurate paleontological and stratigraphic work more apparent. Accordingly in June, 1903, Messrs. T. W. Stanton and J. B. Hatcher were detailed by the survey for a complete reconnoissance, extending from the Belly River beds in the north across the boundary down into the Judith River country, to terminate with the Converse Co., Wyoming, beds west of the Black Hills. Mr. Hatcher has reported by letter and in *SCIENCE* the complete success of this trip. The general conclusion is reached that the Judith River and Belly River are fresh-water deposits overlain by a *portion* of the Fort Pierre and distinctly older than the Laramie.

* 'On Vertebrata of the Mid-Cretaceous of the Northwest Territory,' Geol. Surv. Canada, 'Contributions to Canadian Paleontology,' Vol. III. (quarto), Part II., Ottawa, 1902.

3. *Stegosauria Monograph*.—Mr. F. W. Lucas has completed a preliminary outline for his memoir on the Stegosauria, covering principally the materials preserved in the U. S. National Museum. Mr. Lucas has succeeded in bringing together materials for a corrected restoration of *Stegosaurus*, which differs in important particulars from the restoration by Professor Marsh. It is understood that a model of the animal is in preparation for the St. Louis Exposition.

4. *Sauropoda Monograph*.—The first steps in the preparation of this monograph by Professor Osborn have been taken in the collection of additional material, especially in the Como region of Wyoming, where a deposit, unexampled for richness, has been explored and surveyed under his direction during the past six years. Explorations and studies by Messrs. J. B. Hatcher and E. S. Riggs have also greatly enriched our knowledge of these gigantic reptiles. Two entirely new forms of sauropoda have been discovered, and our knowledge of the forms already known has been extended, so that there is reason to hope that the monograph will contain a complete presentation of the skeleton of several of the known genera of these animals.

The exact stratigraphic work on the Jurassic was begun in the year 1901-2 and was provided for by an appropriation, but unfortunately has been interrupted by the inability of Dr. F. B. Loomis, of Amherst College, to survey the chief section at Cañon City owing to other duties. His sections of the Como region and the Black Hills region have, however, been completed and published by the American Museum of Natural History. Professor Eberhard Fraas, of Stuttgart, is also engaged in the study of the notes and collections made with Professor Osborn in the Jurassic, during 1901-2. He reports that his detailed comparison with the European Jurassic is nearly completed.

5. *Geological Results in Previous Years*.—In the spring of 1901 Mr. Barnum Brown accompanied Professor Lester F. Ward on a short trip into the Lower Trias of Arizona, and secured a number of valuable vertebrate remains, especially of the Phytosauria and

Labyrinthodontia, among the latter the genus *Metopias*, which was found for the first time in this country. This collection is in the National Museum.

In 1902 Mr. N. H. Darton of the Survey accompanied by Mr. J. B. Hatcher and Professor Eberhard Fraas visited the *Titanotherium* beds of South Dakota with reference to the establishment of the geological levels of the various species. Mr. Hatcher was able to confirm and greatly extend his previous observations in connection with the Survey, finally establishing the stratigraphic succession of the greater number of the species of *Titanotheres*.

6. *Progress of Vertebrate Paleontology in America*.—This branch of science covers such a broad field, and the collections made by explorations in the west are so extensive and are multiplying so rapidly, that it is gratifying to report that the number of specialists engaged in the field, in museums and in research work, has rapidly increased, there being now upwards of twenty-five workers. A division of subjects and the friendly cooperation of different institutions have been brought about. Some of these researches, especially those of Prof. S. W. Williston on the pleiosaurs, are on so large a scale that their publication should be undertaken by the government. H. F. O.

SCIENTIFIC NOTES AND NEWS.

DR. G. W. HILL, of Nyack, N. Y., has been elected a corresponding member in the section of astronomy of the Paris Academy of Sciences.

THE Nobel prizes, each of the value of about \$40,000, were awarded in Christiania, on December 10. The prize in physics was divided between M. Becquerel and M. and Mme. Curie, of Paris. The prize in chemistry was awarded to Professor Arrhenius, of Stockholm; the prize in medicine to Dr. Finsen, of Copenhagen, and the prize in literature to Dr. Björnstjerne Björnson, of Christiania. The formal distribution of the prizes took place in the presence of the King and several members of the royal family and a distinguished gathering. A program of music was performed and the usual speeches de-

livered, after which the prize-winners present, MM. Becquerel, Arrhenius and Björnsen received their prizes, with the diploma and Nobel gold medal, from the hands of the King. The absent prize-winners, Professor Finsen and M. and Mme. Curie, were represented by the Danish and French Ministers. It may seem somewhat ungracious to call attention to the fact that three of the four recipients are Scandinavians, whereas Nobel wrote in his will 'I expressly direct that in the award of prizes no attention whatever shall be paid to nationality, so that only the most worthy shall receive the prize, whether he be a Scandinavian or not.' It is also the case that, contrary to the express directions of Nobel's will, about half the income of the fund has been diverted to local uses.

SIR WILLIAM RAMSAY, of London, will give a course of lectures during the summer session at the University of California on 'The Constituents of the Atmosphere and the Emanations from Radium.'

PROFESSOR GEORGE W. HOUGH, of Northwestern University, has been elected an associate member of the Royal Astronomical Society.

PROFESSORS BOVERI (Würzburg), Fürbringer (Heidelberg), Hilbert (Göttingen), Graf zu Solms-Laubach (Strassburg), Weber (Strassburg) and Wiesner (Vienna), have been elected corresponding members of the Munich Academy of Sciences.

WE regret to learn that Dr. Finsen, of Copenhagen, well-known for the discovery of the light treatment of lupus, is dangerously ill.

PROFESSOR L. C. MIALl has been elected Fulmerian professor of physiology at the Royal Institution, London.

DR. H. A. BUMSTEAD, assistant professor of physics at Yale University, will spend a year at Cambridge working in the laboratory of Professor J. J. Thomson.

PROFESSOR W. D. HALLIBURTON, F.R.S., of London University, will give the Herter lectures at New York University in the coming year. He has chosen as his subject 'The

biochemistry of muscle and nerve.' The lectures will commence on January 4, 1904.

THE second Phipps lecture, delivered by Dr. Osler, of the Johns Hopkins University, on December 3, had for its subject 'The Home in its Relation to the Tuberculosis Problem.'

DR. ALEXANDER HUMPHREYS, president of the Stevens Institute of Technology, gave an address on 'The College Graduate as Engineer,' in the College of the City of New York, on December 15.

DR. NORDENSKJÖLD gave a lecture at Buenos Ayres, on December 9, at the Teatro Politeama, in which by the aid of a magic lantern he gave a detailed account of his Antarctic expedition. He stated that he would make known the scientific results of his expedition later, having as yet had no time to coordinate them. M. Skottsberg, the naturalist of the party, gave a full description of the loss of the *Antarctic*.

WE learn from *Nature* that the Rev. T. R. R. Stebbing, F.R.S., has been elected zoological secretary, and a member of the council, of the Linnean Society in succession to Professor G. B. Howes, F.R.S., who has had to retire on account of ill health.

THE tercentenary of the death of William Gilbert, which occurred on November 30, 1903, was celebrated by the British Institution of Electrical Engineers. Papers were read by M. Hospitalier, and Dr. Behn-Eschenburg, and a picture was presented to the city of Colchester, where he was born.

THE body of Herbert Spencer was cremated at Hampstead, on December 14. The Hon. Leonhard Courtney, M.P., made an address. The trustees under Spencer's will are the Hon. Auberon Herbert, Dr. Charlton Bastian and Dr. David Duncan. The executors are Mr. Charles Holme, proprietor of the *Studio*, and Mr. Frank Lott, of Burton-on-Trent. As is generally known, Spencer's autobiography was left stereotyped and ready for the press, and its early publication may be expected.

BENJAMIN FRANKLIN KOONS, professor of natural history and curator of the Museum of the Connecticut Agricultural College, died at

Storrs, Conn., on December 17, at the age of fifty-five years.

WE learn from the *London Times* that a meeting was held on December 10 at the Phototherapeutic Institute, Copenhagen, in celebration of Professor Finsen's success in obtaining the Nobel prize for medicine. It was announced that Professor Finsen had decided to give 50,000 kroner from the amount awarded to him to the institute, and that two members of the governing body would each present it with a like sum.

THE following bill has been introduced into the House of Representatives by Mr. Shafroth and referred to the committee on coinage weights and measures.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That on and after the first day of January, nineteen hundred and five, all the Departments of the Government of the United States, in the transaction of all business requiring the use of weight and measurement, except in completing the survey of public lands, shall employ and use only the weights and measures of the metric system; and on and after the first day of January, nineteen hundred and six, the weights and measures of the metric system shall be the legal standard weights and measures of and in the United States.

THE following are the lecture arrangements at the Royal Institution before Easter: A Christmas course of lectures (illustrated by lantern slides and adapted to a juvenile auditory) on Extinct Animals, by Professor Ray Lankester; Professor L. C. Miall, Fullerian professor of physiology, R.I., six lectures on the Development and Transformations of Animals; Mr. E. Foxwell, three lectures on Japanese Life and Character; Dr. E. A. Wallis Budge, two lectures on the Doctrine of Heaven and Hell in Ancient Egypt, and the Books of the Underworld; Mr. G. R. M. Murray, three lectures on the Flora of the Ocean; Mr. A. D. Hall, three lectures on Recent Research in Agriculture; Professor H. L. Callendar, three lectures on Electrical Methods of Measuring Temperature; Mr. Sidney Lee, two lectures on Shakespeare as Contemporaries knew him; Mr. J. A. Fuller-Maitland, three lectures on British Folk-Song (with vocal illustrations);

Mr. W. L. Courtney, two lectures on Comedy: Ancient and Modern; and six lectures by Lord Rayleigh on Physics. During the season 1904 the lectures on Tuesdays and Thursdays will be delivered at five o'clock, and the Saturday lectures at three o'clock. The Friday evening meetings will begin on January 15, when a discourse will be delivered by Lord Rayleigh on Shadows; succeeding discourses will probably be given by the Rev. Walter Sidgreaves, Mr. D. G. Hogarth, Mr. Alfred Austin, the Dean of Westminster, Mr. H. Brereton Baker, Mr. Alexander Siemens, Professor W. Stirling, Professor F. T. Trouton, Mr. Henry Arthur Jones, Professor Dewar, and other gentlemen.

SIR NORMAN LOCKYER, as we learn from the *London Times*, was the chief guest at the annual dinner of the Sheffield University College on Friday night, December 4. His recent address at Southport as president of the British Association was followed, he said, by 200 leading articles in the newspapers. A great majority of those articles were in favor of the views that he urged, one of those views being that a considerable sum should be set apart by the nation so as to put its educational house in order. Some objections were raised to that address. There was the question of the sum necessary to do this educational work. The sum he estimated as necessary in relation to the actual conditions at the various centers of learning was the sum, capitalized, of £24,000,000—not 24 millions a year. He did not ask for the making of eight new universities; he merely pointed out that England had a commerce to defend and was determined to defend it; that we had gone about that task in a common-sense way and were resolved to be twice as strong as our neighbors, and, carrying out that principle, had built a two-power navy; and he simply suggested that universities were as important in one direction as battleships were in another, and it seemed rather a pity that, if in the matter of battleships England was going to be twice as strong as one power, we should be content to remain only half as strong as one power in regard to universities. There was another critic of his scheme who called it grandiose. But he would like to point out that 24 millions at 2½ per

cent. only meant getting an income of £480,000 a year. That sum of £480,000 was just about half the sum which the German government passed over every year to the German universities. Could it be said that half the sum that Germany gave to her universities was 'grandiose'? Was it not rather mean? Another objection to his Southport address was that he began at the wrong end—with the universities instead of with primary education. But surely, when the British government had in the last thirty years spent 420 millions sterling on primary schools, primary education could be regarded as the affair of the government and very properly left in its hands. He at any rate did not wish the stream of education to be dammed in any way by anything. Let every British child begin at the best primary school it could get, and end, if it was capable, at the best university it could get.

THE Government of India reports, according to an abstract in the *London Times*, that in 1901 more human beings were killed by wild animals than in any year since 1875 except one, and reached a total of 3,651, while last year it was 2,836, and the number of deaths from snake-bite was 23,166. Tigers killed 1,046 persons, of which 544 occurred in Bengal, 65 being in a single district. This was due to the depredations of a man-eater, for the destruction of which a special reward was offered without avail. In another district where 43 persons were killed most of them fell victims also to a man-eater. Wolves slew 377 persons last year, of whom 204 were killed in the United Provinces. A campaign was undertaken against these animals in Rohilkhand and the Allahabad division, and they have been almost exterminated in Cawnpore district, where they used to abound. 80,796 cattle were killed by wild animals last year, and 9,019 by snakes. Tigers killed 30,555 of these, leopards 38,211, and wolves and hyenas most of the remainder. On the other hand, rewards were paid last year for the destruction of 1,331 tigers, 4,413 leopards, 1,858 bears, 2,373 wolves, and 706 hyenas, while the number of snakes killed for reward was 72,595.

UNIVERSITY AND EDUCATIONAL NEWS.

MR. ATWOOD MATTHEWS has bequeathed £5,000 each to the general funds of the university and of Trinity College, Cambridge, and the Hon. George Charles Brodrick has bequeathed £4,000 and his pictures and engravings to Merton College, Oxford, of which he was warden.

MARSH HALL, occupied by the Yale Forest School was injured by fire on December 11, the loss being estimated at about \$10,000.

THE College Entrance Examination Board of the Middle States and Maryland, which was organized three years ago to direct the entrance examinations of the principal colleges and universities in the east, has extended its influence to such a degree that it has now dropped the qualifying phrase and is now 'the College Entrance Examination Board.' The examiners for the current year include the following: *Mathematics*—Chief Examiner, Professor Frank N. Cole, Columbia University; Associates, Professor Thomas C. Esty, University of Rochester, and Dr. Arthur Schultze, De Witt Clinton High School, New York City. *Physics*—Chief Examiner, Professor Edward L. Nichols, Cornell University; Associates, Professor Francis C. Van Dyck, Rutgers College, and Frank Rollins, Morris High School, New York City. *Botany*—Chief Examiner, Professor William F. Ganong, Smith College; Associates, Professor Henrietta E. Hooker, Mount Holyoke College, and Louis Murbach, Central High School, Detroit, Mich. *Chemistry*—Chief Examiner, Professor Leverett Mears, Williams College; Associates, Professor Charlotte F. Roberts, Wellesley College, and Albert C. Hale, Boys' High School, Brooklyn, N. Y.

MR. LEWIS BURTON ALGER, Ph.B. (Michigan), A.M. (Columbia) has been appointed junior professor of education at the University of Michigan.

MR. W. C. FLETCHER has been appointed to the newly established post of chief inspector of secondary schools in Great Britain. Mr. Fletcher was second wrangler at Cambridge in 1886.

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